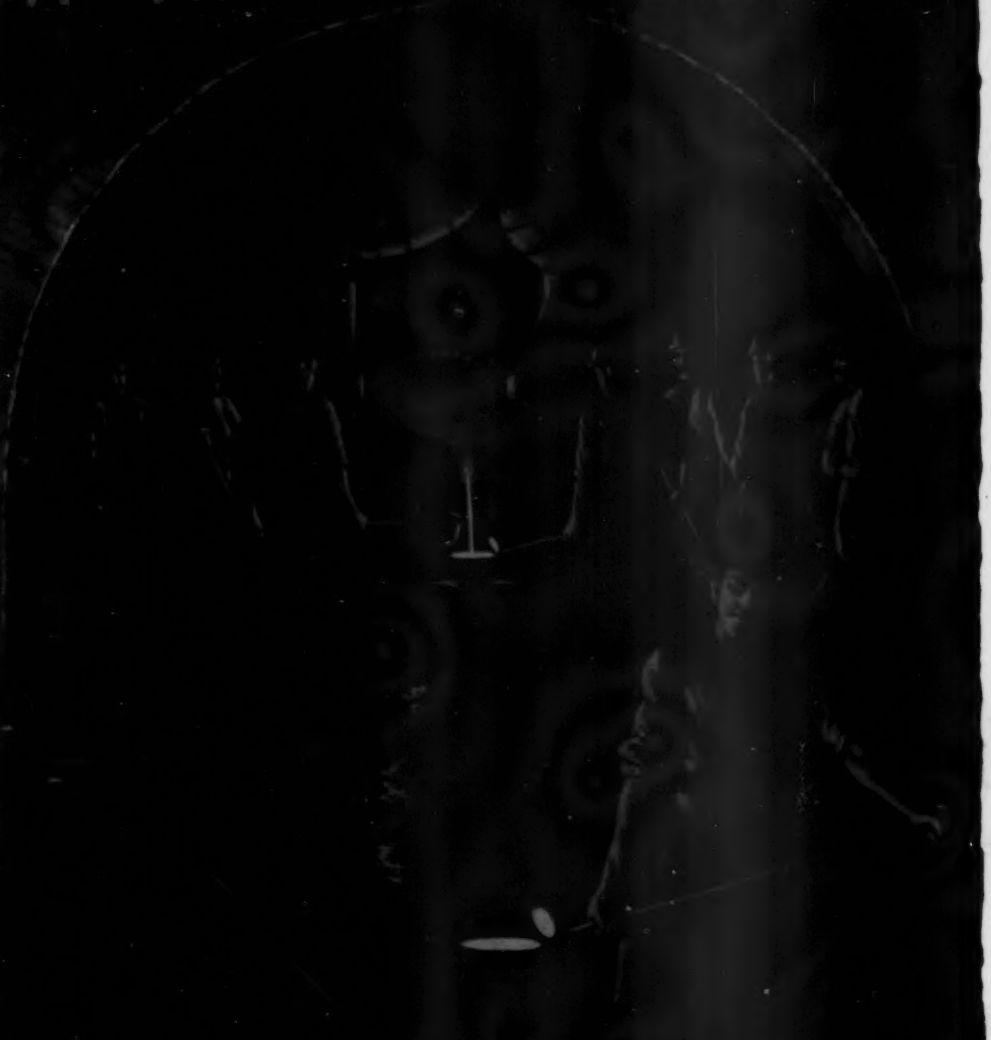
Vol. 24 APRIL, 1904 No. 140

THE FOUNDRY

A TRADE JOURNAL



Devoted to the interests of the whole Foundry Business.

PUBLISHED MONTHLY BY

THE IRON AND STEEL PRESS CO.

CLEVELAND OHIO

Send for Samples and Prices

ESSO CORE FLOUR

It's the very best foundry flour ever placed on the market. It requires less to make good cores, at same time our prices are right. Shipped in carloads or less.

TO convince you that we have "*Everything you need in your Foundry*," we would suggest you write for our

GENERAL CATALOGUE No. A40

which is the standard book on FOUNDRY FACINGS, BLACKINGS, FOUNDRY SUPPLIES AND EQUIPMENTS. A book of excellent information for every foundryman. A book every foundryman should have on his desk.

This Catalogue we *express free* to the foundrymen of the world, with express charges prepaid.

ESTABLISHED 1874

Manufacturers "EVERYTHING YOU NEED IN YOUR FOUNDRY"

The S. Obermayer Company

CINCINNATI
CHICAGO
PITTSBURG

ESTABLISHED 1874

WE ARE HEADQUARTERS FOR

BITUMINOUS OR SEA COAL FACING

Shipped in carload or less from our LARIMER, PA., PLANT. (Larimer is 22 miles east of Pittsburg.)
Our BITUMINOUS or SEA COAL FACING is acknowledged to be the BEST, made from high-grade crude material and GROUND VERY FINE AND UNIFORM.

We make a specialty of
BOLTED SEA COAL FACING

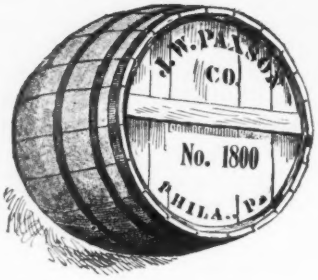
THE S. OBERMAYER CO.

CINCINNATI CHICAGO PITTSBURG

WE ARE SOLE MANUFACTURERS

702 PURE CEYLON PLUMBAGO
RELIANCE CORE WASH and BLACKING
PEERLESS PERFECT CORE WASH

J. W. Paxson Co.



Ceylon Lead

FOR FOUNDRY USE
is one of our specialties.

KLONDIKE	for Light Machinery
XX CRUCIBLE	for Medium Machinery
No. 1800	for Heavy Machinery
No. 1500	for Wet Blacking
No. 1604	for Heaviest Machinery

BITUMINOUS FACING — ANTHRACITE FACING
CHARCOAL FACING — STOVE PLATE FACING
WHITE TALC FACING — YELLOW TALC FACING

Shipments made on same day orders received.

HAY ROPE, CORE COMPOUND, etc.

The Paxson-Warren Sand Blast

will clean your castings QUICKER,
MORE ECONOMICALLY and CLEANER
than by any other process.

Your Inquiries will Receive Prompt Attention

PHILADELPHIA, PA.

J. W. Paxson Co.

CHAPLETS CARRIED IN STOCK

Fig. 132.

Tinned

Pricker-Head Chaplets

Fig. 128.

Tinned

Wrought-Iron Chaplets

WITH FORGED HEADS

PRICE PER HUNDRED

Diameter of Head	1/2, 11/16, 13/16	1 1/8	1 1/4	1 1/2	1 3/4
Diameter of Stem	1/8, 3/16, 1/4	5/16	3/8	1/2	5/8
Length					
3 inches	$1 55	$1 83	$2 10	$3 53	$5 33
3 1/2 "	1 60	1 90	2 20	3 70	5 60
4 "	1 65	1 97	2 30	3 87	5 87
4 1/2 "	1 70	2 05	2 40	4 05	6 15
5 "	1 75	2 13	2 50	4 22	6 42
5 1/2 "	1 80	2 20	2 60	4 40	6 70
6 "	1 85	2 27	2 70	4 58	6 98
6 1/2 "	1 90	2 35	2 80	4 75	7 25
7 "	1 95	2 43	2 90	4 97	7 57
7 1/2 "	2 00	2 50	3 00	5 10	7 80
8 "	2 05	2 57	3 10	5 30	8 10
9 "	2 10	2 62	3 30	5 65	8 65
10 "	2 15	2 68	3 50	6 00	9 20
11 "	2 20	2 75	3 70	6 35	9 75
12 "	2 25	2 80	3 90	6 70	10 30

Discount.....

We carry a stock all sizes of these Chaplets for immediate shipment.

=

Double Head, either light or heavy stems, also carried.

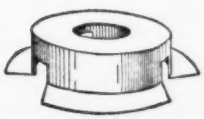
=

Sold in no less quantity than 100 to each package.

=

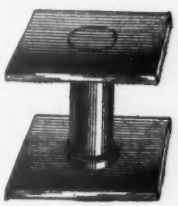
GIVE US A TRIAL FOR QUICK SHIPMENT.

=



TIN DUP

OUR CHAPLETS ARE ALL TINNED



PHILADELPHIA, PA.

NEW

Paxson-Colliau Cupola

The more you examine it, the better you will like it . . . . . .

The Acme of Science in Cupola Construction . .

All that was Best in the old Colliau Cupola, with Every Improvement suggested by long experience added.

Location and area of tuyeres insure the . . highest melting . . . . efficiency . . . . . .

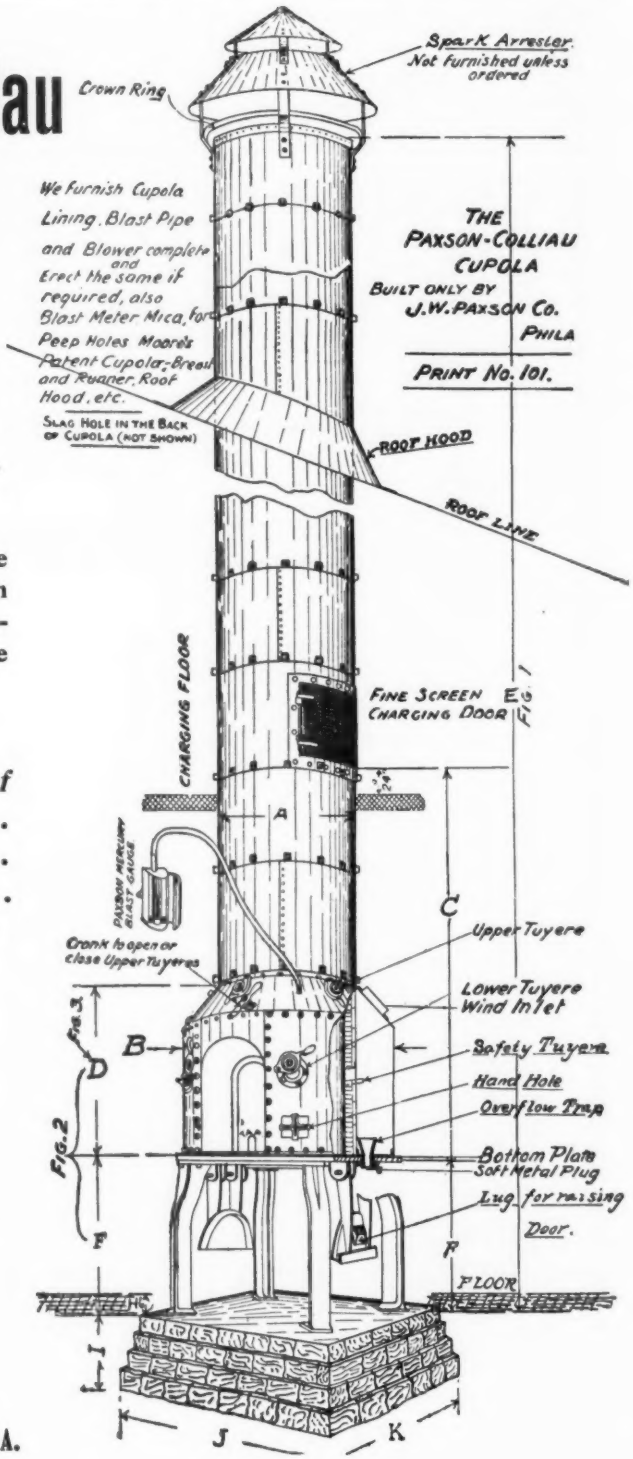
It keeps us hustling to fill the orders for these goods.

MADE ONLY BY THE

J. W. Paxson Co.

1021 . . .
North Delaware Avenue,

PHILADELPHIA, PA., - U. S. A.



Are You Using Our

VULCAN BLACKING

FOR DRY SAND AND LOAM WORK?

If not

TRY A BARREL OF IT

and you will use no other

❡ The name VULCAN is our REGISTERED TRADE MARK and we warn manufacturers from using this name and others against purchasing any Blacking or Facing not sold by us, having this brand.

Foundry Supply Depot

J. S. McCORMICK CO.

PITTSBURG, PA.

We claim to make the BEST PLUMBAGO, FOUNDRY FACINGS and SUPPLIES produced in the United States today. This is a BROAD statement, but the truth permits of no qualifications; we either DO or we DON'T.

YOU WANT THE BEST

We honestly believe that our goods are SUPERIOR to those you are now using. We want you to know this, you to be the judge and decide upon the merits of our claim, after a thorough trial in your own shop on your own work.

Ground Goods

PLUMBAGO
INDIA SILVER LEAD
GRAPHITE
FOUNDERS' PERFECT WASH
CORE WASH
HEAVY MACHINE FACING
RHODE ISLAND FACING
HEAVY STOVE-PLATE FACING
RETURN FACING
CHARCOAL FACING
INGOT MOLD WASH
XXX MINERAL FACING
SOAPSTONE OR TALC
COKE BLACKING
PIPE BLACKING
BOLTED CEMENT
SEA OR STONECOAL

The Hill & Griffith Co.

Cincinnati, Ohio, U.S.A.

Correspondence Solicited

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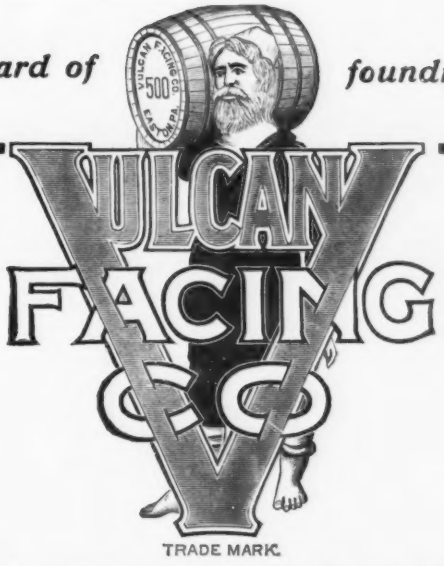
CUPOLAS
LADLES
FIRE BRICK
SHOVELS
RIDDLES
BELLOWS
WHEELBARROWS
HAND AND POWER SAND SIFTERS
BRUSHES
CHAPLETS
PATTERN LETTERS
FOUNDRY TORCHES
SNAP FLASKS
FOUNDRY BUCKETS
MALLETS
"SMOOTH-ON" IRON CEMENT
CRUCIBLES AND BRASS FOUNDERS' SUPPLIES

We have the courage of our convictions—what we want you to do is to give the goods a trial, and if, after the test is made, you do not agree with us, we will charge you nothing for the goods, but will expense the cost to over-confidence.

WE SELL THE BEST

Please bear in mind, our prices are no higher than you are paying. We ask for your patronage on the basis of giving you a BETTER value for the SAME money. It's only the first order we are asking for. You will send the others.

The standard of *foundry excellence*



TRADE MARK.

A trade mark that is a guarantee of Merit and Value

Vulcan Dry Sand Blacking

It is well understood amongst the Foundry Trade that the sterling qualities of our Dry Sand Blacking commends it in core work, loam and dry sand practice. If you are having trouble in getting a surface on your castings free from impurities, try our goods and you will be using the article many of the leading foundries have adopted to insure good work.

CEYLON PLUMBAGO. Our whole claim for our CEYLON PLUMBAGO is that it is pure in quality, finely ground, and when you purchase you have our absolute guarantee that you are receiving the best article obtainable, without paying a fancy price.
In GERMAN, AMERICAN and CANADIAN PLUMBAGO we are prepared to quote an exceptionally low price in car lots. If you are interested write us for quotations.

SEA COAL FACING. If you are in need of Bituminous Facing for Green Sand work, and want prompt delivery, give us a trial order. You will find our prices good and delivery of a nature to attract your attention.

ANTHRACITE BLACKING. From the Cast Iron Pipe and Foundry Trade interested in ANTHRACITE BLACKING we solicit a chance to quote on the best article of finely ground, hard Anthracite selected coal in car lots.

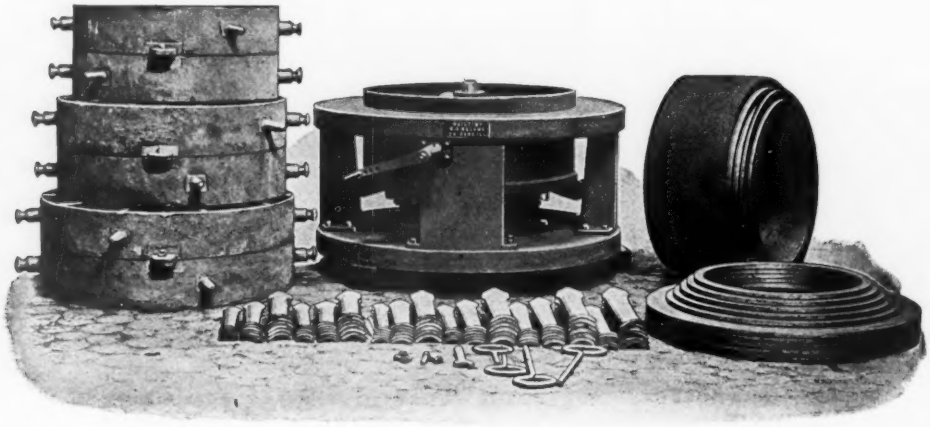
SOAPSTONE, MINERAL, RHODE ISLAND and STOVE-PLATE FACINGS ready for prompt shipment in car lots or smaller quantities.

Our new Booklet on Foundry Practice is now ready. Free to the Trade.

VULCAN FACING CO. **Easton, Pa.**

Pulley Moulding MACHINERY

Built by THE E. A. DELANO CO. **50 to 56 S. Clinton St., Chicago, Ill.**

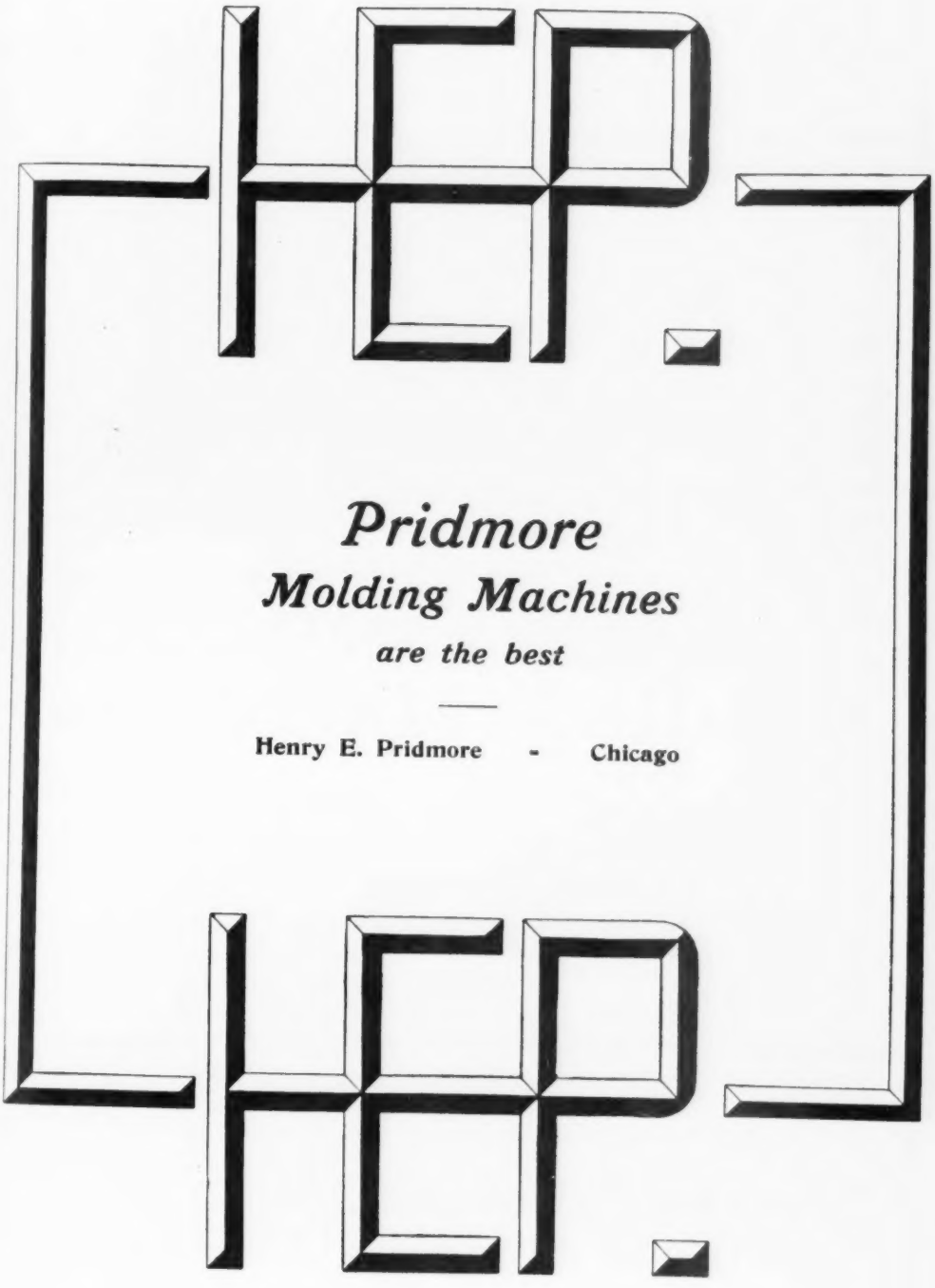


The above cut shows our No. 3 Pulley Moulding Machine with a complete equipment for making all sizes of iron pulleys from 26 in. to 36 in. diameter and any face. We make machines to cast any size and description of iron pulleys between 3 in. and 72 in. Our catalogue P. M.-1 is yours for the asking.

A Partial List of Representative Users of these Machines.

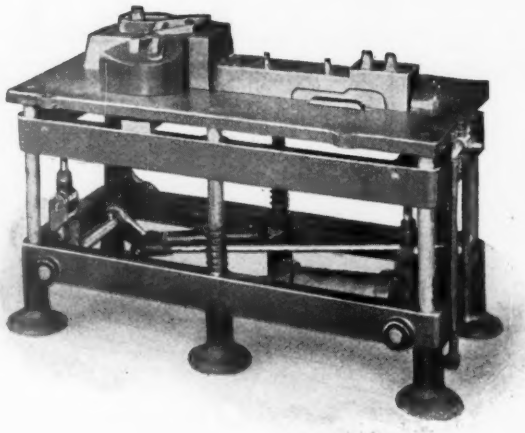
Allis-Chalmers Co., Milwaukee, Wis.
The Jeffrey Mfg. Co., Columbus, Ohio.
Allis-Chalmers Co., Chicago, Ill.
Falls Rivet & Machine Co., Cuyahoga Falls, Ohio.
Fraser & Chalmers, London, England.
Golden's Fdy. & Machine Co., Columbus, Ga.
Webster Mfg. Co., Chicago, Ill.
Woonsocket Machine & Press Co., Woonsocket, R. I.
Lane Mfg. Co., Montpelier, Vt.
Franklin Machine Co., Providence, R. I.
James Frake, Chicago, Ill.
Baush Machine Tool Co., Springfield, Mass.
Pratt & Whitney, Hartford, Conn.
Pyott Fdy. Co., Chicago, Ill.
Crowell Clutch & Pulley Co., Westfield, N. Y.
Clark Bros., Belmont, N. Y.
Henry Roos Foundry Co., Chicago, Ill.
Naylor Bros., Peekskill, N. Y.
Meese & Gottfried, San Francisco, Cal.
Avondale Stove & Foundry Co., Birmingham, Ala.
H. N. Strait Mfg. Co., Kansas City, Kan.
W. E. Caldwell Co., Louisville, Ky.
Samuel C. Tatum Co., Cincinnati, Ohio.
D. J. Murray Mfg. Co., Wausau, Wis.
Wheelands Machine Works, Chattanooga, Tenn.
Co-operative Foundry Co., Detroit, Mich.
Lombard Iron Works & Supply Co., Augusta, Ga.
Geo. V. Cresson, Philadelphia, Pa.
Bates Machine Co., Joliet, Ill.
A. & F. Brown Co., New York City.
W. A. Jones Fdy. & Machine Co., Chicago, Ill.
Holyoke Machine Co., Worcester, Mass.
Erie City Iron Wks., Erie, Pa.
Continental Gin Co., Prattville, Ala.
Henry Vogt Machine Co., Louisville, Ky.
Link Belt Machinery Co., Chicago, Ill.
Aurora Foundry Co., Aurora, Ill.
W. T. Eaton Mfg. Co., Libertyville, Ill.
Standard Pulley Mfg. Co., New Orleans, La.
The National Machinery Co., Tiffin, Ohio.
De Loach Mill Mfg. Co., Atlanta, Ga.
Utica Steam Engine & Boiler Works, Utica, N. Y.
Willamette Iron & Steel Wks., Portland, Ore.
Dodge Mfg. Co., Toronto, Canada.
Colorado Iron Wks., Denver, Col.
Huntley Mfg. Co., Silver Creek, N. Y.
R. Hoe & Co., New York City.
Builders Iron Foundry, Providence, R. I.
Southern Engine & Boiler Wks., Jackson, Tenn.
Deane Steam Pump Co., Holyoke, Mass.
Kay-Pim Mfg. Co., St. Louis, Mo.
Richmond City Mill Wks., Richmond, Ind.
The Central Fdy. Co., Hamilton, Ohio.
The Wolf Co., Chambersburg, Pa.
Olympic Fdy. Co., Seattle, Wash.
Garden City Fan Co., Niles, Mich.
Mobile Stove Works, Mobile, Ala.

Agents for Great Britain: J. W. JACKMAN & CO., 39 Victoria St., London.


Pridmore
Molding Machines
are the best
Henry E. Pridmore - Chicago

Are You in the Ox Wagon?

If BEN HUR had driven an Ox Wagon in his celebrated race, he could hardly have expected to win. Yet *Ox Wagon Methods Prevail* in many foundries today, and in the race for profitable business, many foundrymen are losing ground.



Maywood Molding Machines

will help you to make money on jobs that must be taken at close prices on account of competition. Of course, there are other machines but none better than the MAYWOOD. :: :: :: :: ::

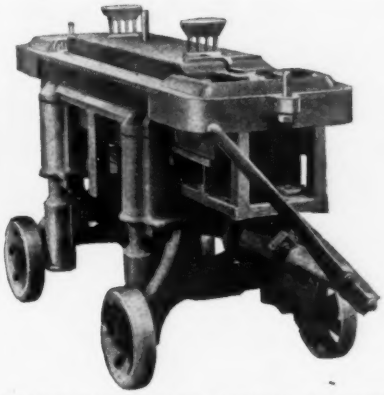
Because

Simplest in construction
Easiest to operate or change patterns
Most accurate in alignment
Most perfect in adjustment

Write today for particulars

Maywood Foundry & Machine Company

1606 Tribune Bldg., Chicago



DRAPER-TABOR HAND RAMMING MACHINE
A PLAIN STRIPPING PLATE MACHINE
—WITH A VIBRATOR IF YOU WANT IT

A PARTIAL LIST OF THE DIFFERENT MACHINES WE MANUFACTURE:

Hand Ramming Split Pattern Machines
Hand Ramming Stripping Plate Machines
Hand Ramming Vibrator Frame Machines
Foot Pressure Core Machines

(THOMAS-CLAIRE PATENT)
VERY FAST

MOLDING MACHINES

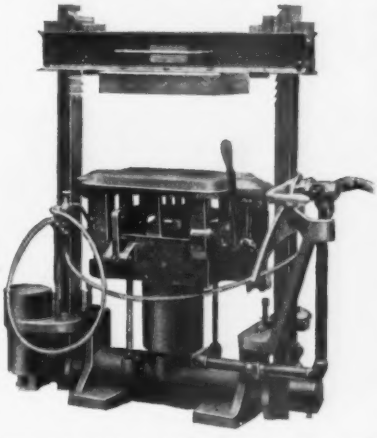
Power Ramming Split Pattern Machines

Power Ramming Stripping Plate Machines

Power Ramming Vibrator Frame Machines

Power Ramming "Squeezers"

Power Ramming Machines for deep work on which no hand work is necessary regardless of depth. Power Ramming Machines for very large work in flasks 34″ x 42″ to 40″ x 90″ for Steel Castings, TUNNEL PLATE SEGMENTS, etc.



LIGHT POWER RAMMING SPLIT PATTERN VIBRATOR MACHINE WITH HAND DRAFT

The Tabor Manufacturing Company

18th and Hamilton Streets, Philadelphia, Pa.

Chicago Office
30 and 32 S. Canal Street

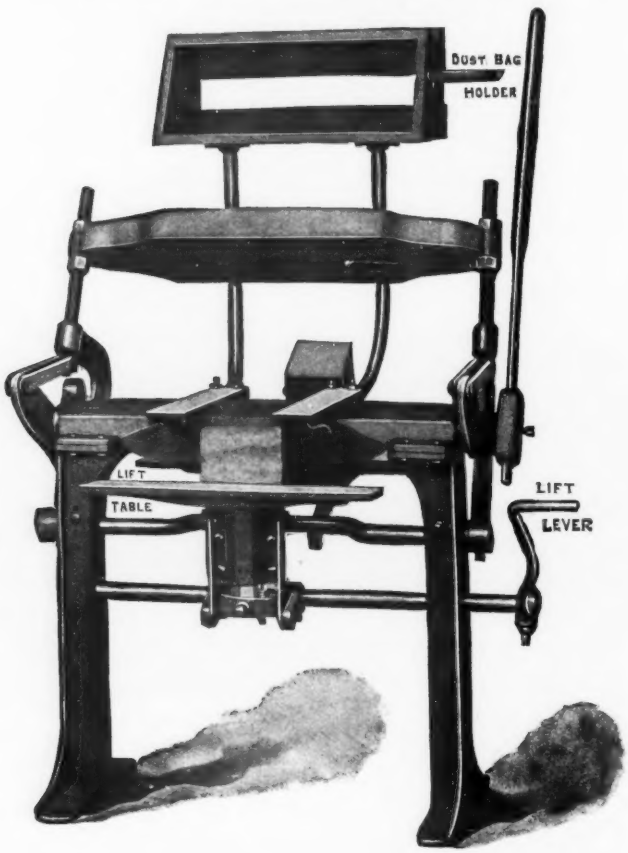
Fenwick Freres
Paris

49, Deansgate
Manchester, England

Schuchardt & Schutte, Berlin

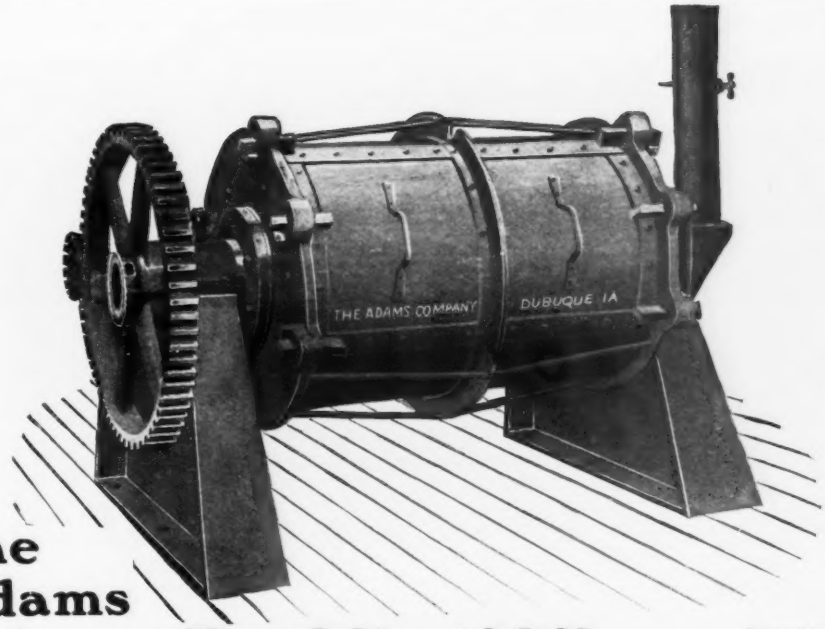
MOLDING MACHINES

Send for Catalog No. 9



The Adams Company,

J. W. Jackman & Co., London, S. W., England
H. Glaenzer & Perreaud, Paris, France
V. Lowener, Copenhagen, Denmark



The Adams Exhaust Tumbling Mill

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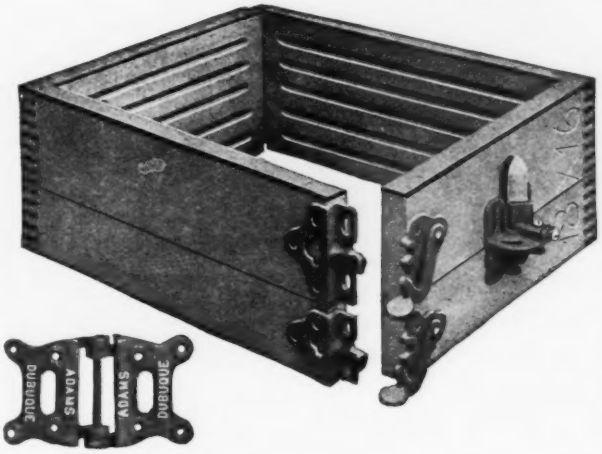
The Adams Cherry Snap Flask



Selected Dry Cherry

1 1-16 inches thick, is used in our flasks which alone costs more than all of the material used in the ordinary flask.

Corners

of the flask are machine locked, giving greater surface for gluing and a stronger joint than is possible to obtain from a dovetail or mitre.

Top Irons

which protect the edges of both cope and drag are ⅛ x 1 inch wrought iron with WELDED CORNERS, which make the flask more rigid.

Trimmings

are of malleable iron. The snaps are without doubt the quickest snaps to operate.

Pins and Ears

of malleable iron, have ¾ inch milled bearing on each side of the right angle. Fine adjustment in both ears is provided for by means of a screw on the ends of the ears. Both ears being adjustable, cope and drag are easily kept in line.

Dubuque, Iowa, U. S. A.

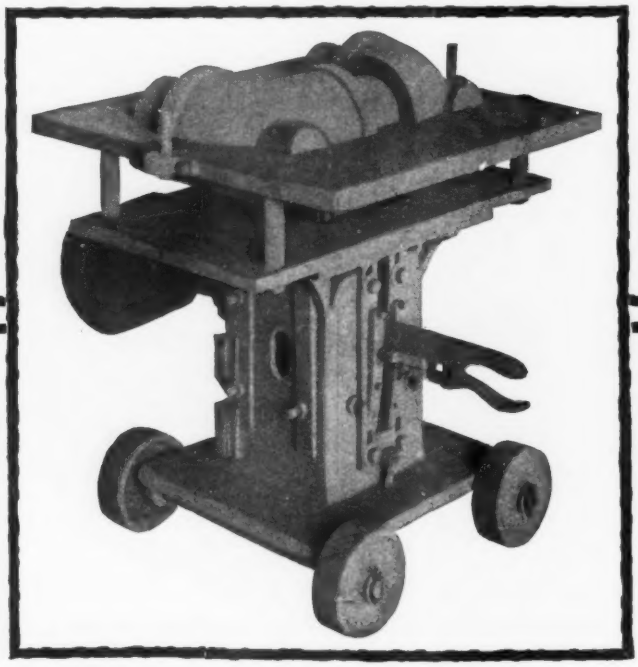
Ing. G. Pontremoli & Co., Milan, Italy
Wynmalen & Hausman, Rotterdam, Netherlands

THE MOLDING MACHINE

NO FAD *but a* MATTER *of* ECONOMY

TO THE INTELLIGENT FOUNDRYMAN

Are you in this class, Mr. Proprietor, or Foreman?
If so, you ought to be using this machine.



IT IS

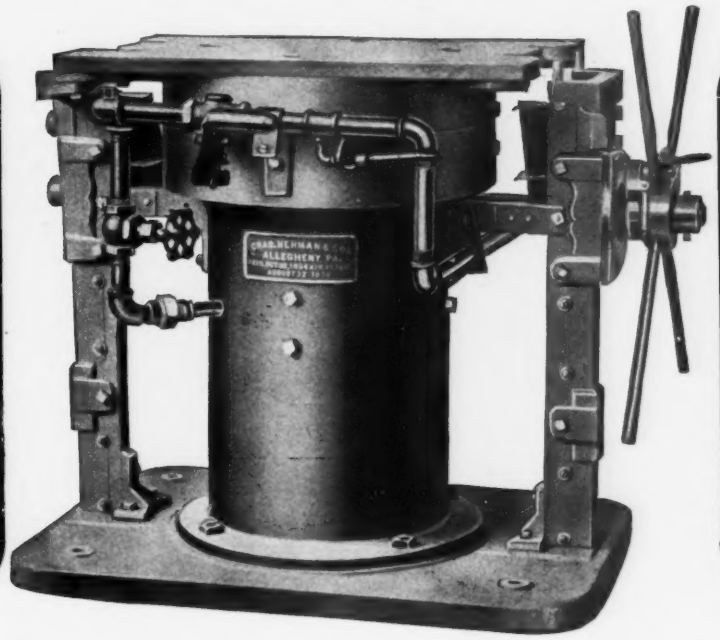
SIMPLE
EASILY ADJUSTED
NEVER BURDENED WITH A BILL OF REPAIRS
A MONEY MAKER

TAYLOR, WILSON & CO., LIMITED

102 GRANT AVENUE ALLEGHENY, PA.

The Deeper the Flask The Greater the Gain

Herman Pneumatic Jarring Molding Machine



When machine is installed it is not necessary to wait until stripping plates and interchangeable flasks are made.

Deep drag patterns, that you are using for floor work, may be placed on machine table, the machine does the ramming and the patterns are drawn by hand.

The machine jars or rams up a mold in a few seconds, makes a perfect mold and there is absolutely no blowing or scabbing.

The advantage over hand ramming alone is sufficient to pay the outlay for machine.

One of our customers says he is putting up a day's work the above way, in two hours.

When stripping plates are used, less operations are required and more molds can be turned out.

We lift stripping plates with air hoists attached to machine, requiring no hard work when there is a high lift, and the molds weigh from 200 to 1000 pounds.

WRITE FOR CATALOGUE

CHAS. HERMAN & SON

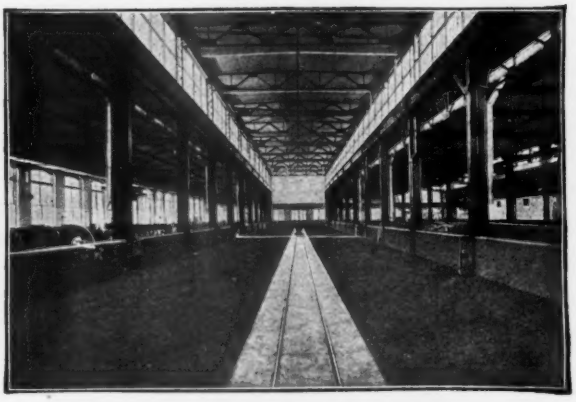
SHARPSBURG, PA.

Pneumatic Engineering Appliances Company, Ltd., Palace Chambers, Westminster, London, Eng., Foreign Representatives

VENTILATE AND HEAT

your FOUNDRY by the

Sturtevant System



Two views in our foundry, heated and ventilated by the Sturtevant System.

The same apparatus that heats and ventilates in winter, cools and ventilates in summer.

B. F. STURTEVANT CO.

BOSTON, MASSACHUSETTS

New York Philadelphia Chicago London

366

ROOTS'

Established 1859

POSITIVE PRESSURE BLOWER

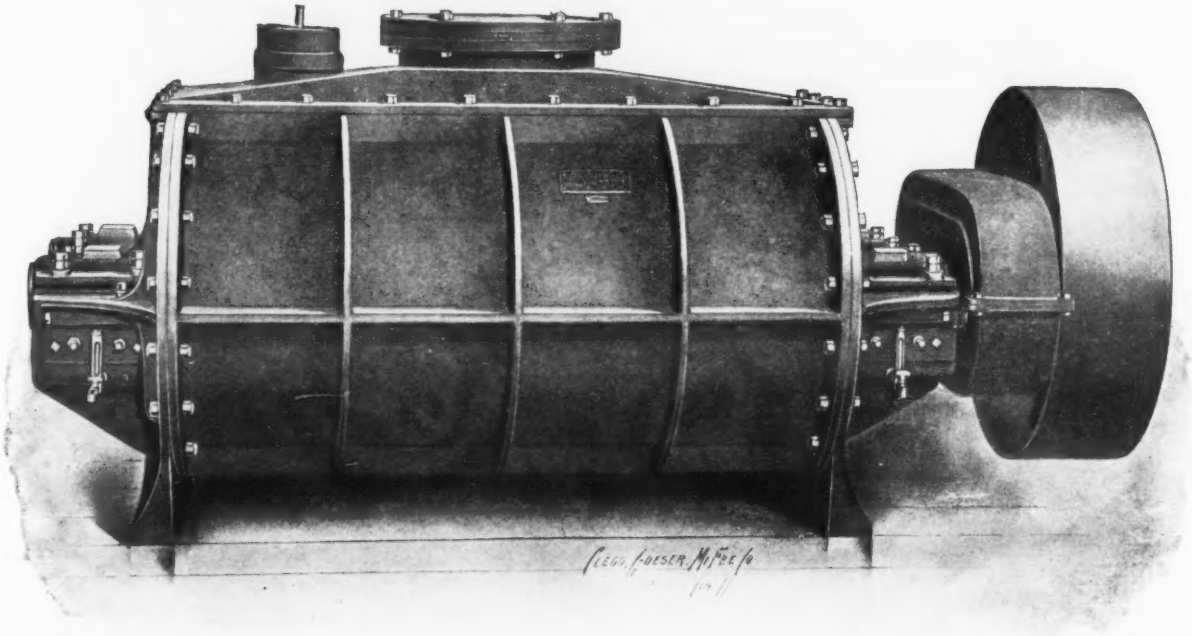
Judging from our orders, it is evident that foundrymen all over the country are convinced of the superior merits of Roots' Blowers.
Everything to gain, nothing to lose by using our Blowers.

P. H. & F. M. ROOTS CO.

Home Office and Works:
CONNERSVILLE, INDIANA, U. S. A.

NEW YORK OFFICE,
120 and 122 Liberty St.

CHICAGO OFFICE,
1547 Marquette Bldg.



Our Latest Improved Foundry Blower.

"A B C"
HEATING · VENTILATING · DRYING
MECHANICAL DRAFT APPARATUS

CATALOGUES UPON REQUEST
AMERICAN
BLOWER CO.
DETROIT
NEW YORK CHICAGO LONDON

FREE SAMPLE

of any of the

SMOOTH-ON

Iron or Steel Cements

to any one mentioning this advertisement; and our new book telling about the different combinations of Smooth-On.

The latest are Smooth-On Elastic Cement and Smooth-On Iron Cement Sheet Packing. They will interest you.

Smooth-On is for sale by all Foundry Supply people in United States and Canada. Cements sold in 1, 5, 10 and 25 pound tins.

SMOOTH-ON MANUFACTURING CO.

572-574 Communipaw Ave., JERSEY CITY, N. J., U. S. A.

CHICAGO OFFICE
61-69 N. Jefferson St.

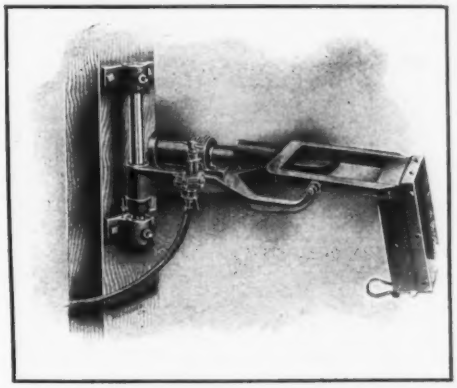
SAN FRANCISCO OFFICE
61 Steuart St.

AGENTS FOR GREAT BRITAIN
Messrs. Hodgson Hartley, Ltd., 55 Victoria Bldgs., Manchester, England

KEEP UP WITH THE TIMES AND EQUIP YOUR PNEUMATIC MOLDING MACHINE WITH A

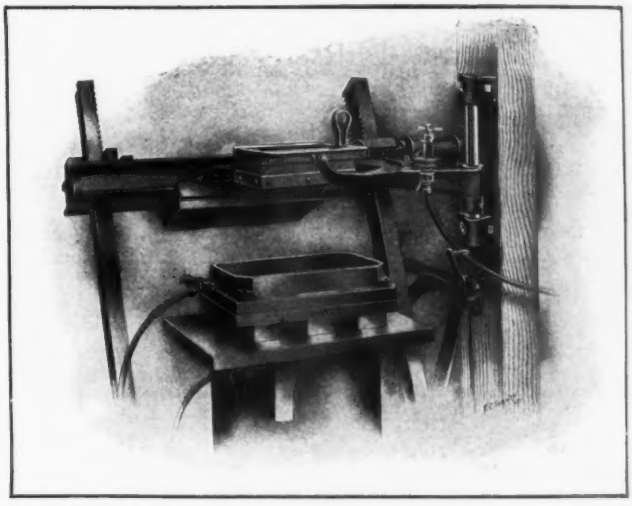
Hanna Swivel Post Shaker

Adjustable for Different Heights of Flasks



Provided with Removable Screens

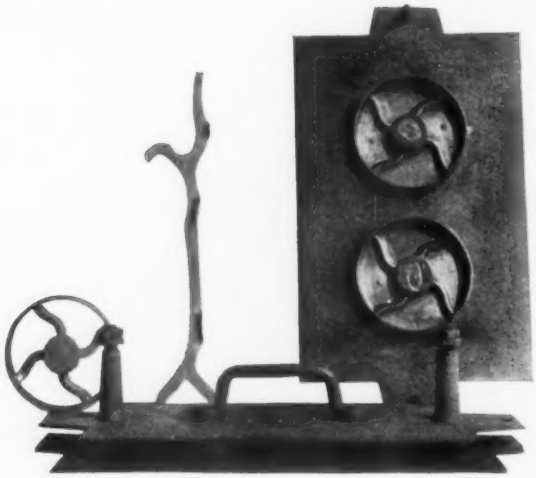
Arranged to start automatically when shaker is swung into position for riddling, and stops when swung away.



We make other styles of Shakers also. Write for particulars.

Hanna Engineering Works, 820 Elston Ave., CHICAGO

MAKE YOUR OWN MOLDING MACHINES



SHOP RIGHTS FOR SALE At about one-tenth the cost of other machines you can make a SIMPLEX MOLDER and thereby give many jobs the benefit of machine molding that, under other conditions, would not be profitable.

Our terms are so reasonable that any foundry can afford to purchase the right. Any machine shop can construct these Molders, and when installed in your foundry, you will find they are equal to any machine in speed and accuracy, the superior to any in economy and simplicity.

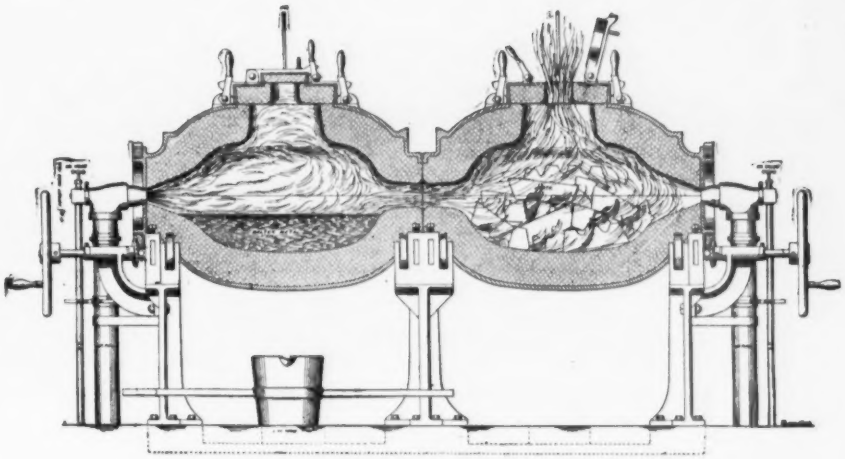
WILL FIGURE ON SHOP EQUIPMENT.

Simplex Molding Machines

THE HARRIS COMPANY

65 South Canal Street **CHICAGO**

Rockwell Rotary Melting Furnace



FURNACE IN SECTION SHOWING ACTION OF HEAT

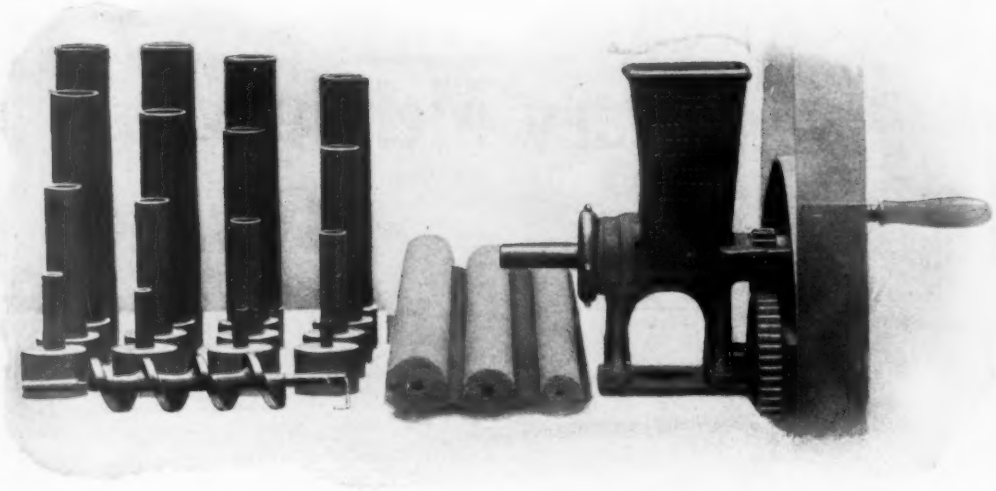
SAVES METAL AND MONEY

This furnace utilizes the heat from the spent gases of combustion. Two kinds of metal can be melted at the same time or both chambers can be used for one kind. The lining is an inexpensive material rammed into the furnace shell in bulk and burned hard and refractory in place. Large output for floor space required. No complicated parts or expensive repairs. Oil or gas is used as fuel, and the air for combustion is supplied from an ordinary fan. For general convenience and cleanliness, it is unequaled.

Made in four standard sizes ranging in capacity from 350 to 3,000 pounds each chamber.

ROCKWELL ENGINEERING COMPANY
26 CORTLANDT STREET
NEW YORK

ROUND, HEXAGON OR OVAL CORES, VENTED END TO END



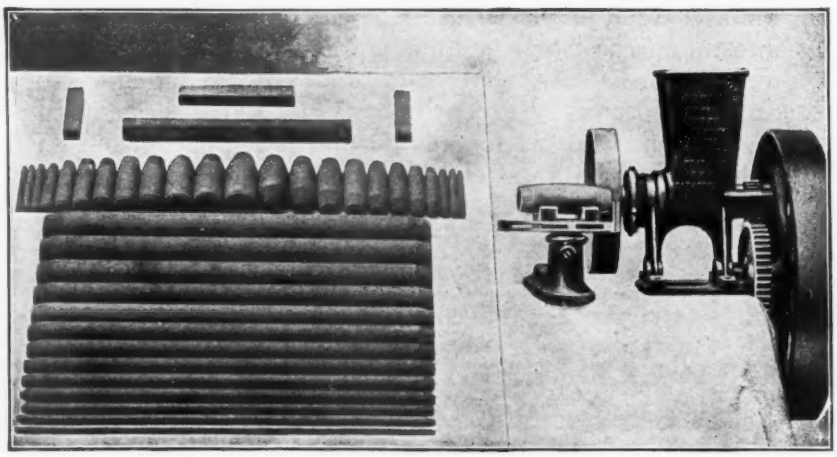
STANDARD STOCK CORE MACHINE.

Suit decided in our favor by
United States Circuit Court, October 13, 1903

Hundreds of Machines in daily use
Cores from 3-8″ to 6″

Send for new Catalog

The Railway Speed Recorder Co.
Kent, Ohio, U. S. A.



CUTTING OFF ATTACHMENT.

"Ridgway's a Harpin'

On the same old string all the time!"

Sure! And why not?

Who ever gets tired of a good, sweet song if it's true? And the Ridgway song is true or we could not have sung it all these years and have you turning to it to-day to hear it for the—well, how many times?

Yes, brother, Steam Hydraulic is all we know, and we want you to know what a splendid thing it is and you will be using the Ridgway machines with the rest of them.

We save our friends thousands of dollars when we get these machines, either cranes or elevators, in their works, and that is why all our customers are so much more than customers.

We don't suppose there is another concern that gets such fun out of business as we do. When we enter a business place everybody is glad to see us, and such letters as we get! Well!!

We do people good. We want to do you good, too. Why don't you try us just once and see?

OIL GOVERNED AIR HOISTS

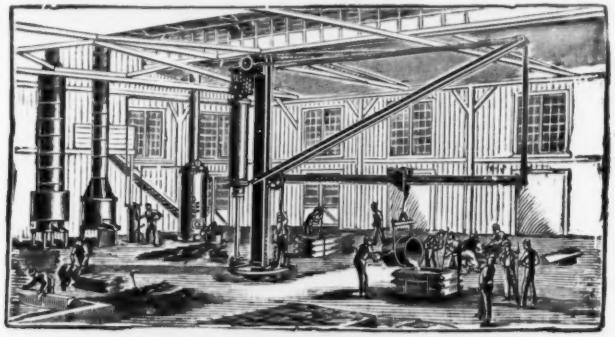
These five lines are all we say about it.
A little oil in the piston rod makes the air hoist perfect.
You would be surprised how unsatisfactory other hoists are.
Get one of these—try it—keep it or send it back.

PLEASE TAKE THE ELEVATOR

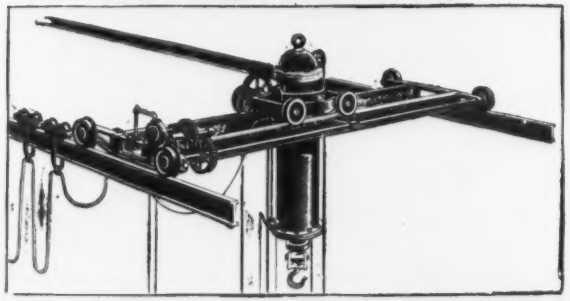
"Hook'er to the Biler."

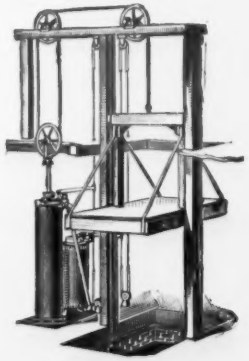
CRAIG RIDGWAY & SON CO., Coatesville, Pa.

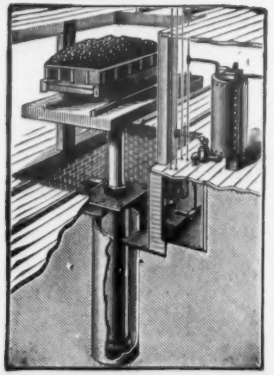
European Agent, CHAS. G. ECKSTEIN, 49 Kaiser Wilhelmstr., BERLIN, GERMANY.



5-Ton Steam Hydraulic Crane in a Foundry.







JOSH BILLINGS SAYS

"I love a Rooster for tew things—one is the krow that is in him, and the other is the spurs that air on him to bak up his krow with."

WE "KROW"!

BECAUSE

We have "The Spurs." We can save money for you. We have the confidence of a large majority of the iron and steel workers in all lines and in all countries.

OUR "SPURS"

CAST STEEL CEMENT

"TO BAK UP OUR KROW WITH"

It is Permanent—no mere Filler-up or Smoother-over. It becomes a part of the casting itself.

TEN YEARS' REPUTATION

Iron and Steel Castings made Perfect and at a cost of but a few cents. : :

DON'T THROW AWAY GOOD CASTINGS

THE CLARK

Write for free sample

TRADE

CAST STEEL

MARK

Write for free sample

CEMENT CO.

SHELTON, Conn., U. S. A.

Agents: J. W. JACKMAN & CO., 39 Victoria St., London, Eng.
BENJAMIN C. ELLIOTT, 33 Tehama St., San Francisco, Cal.
J. HOWARD JONES & SON, 355 Dearborn Street, Chicago, Ill.
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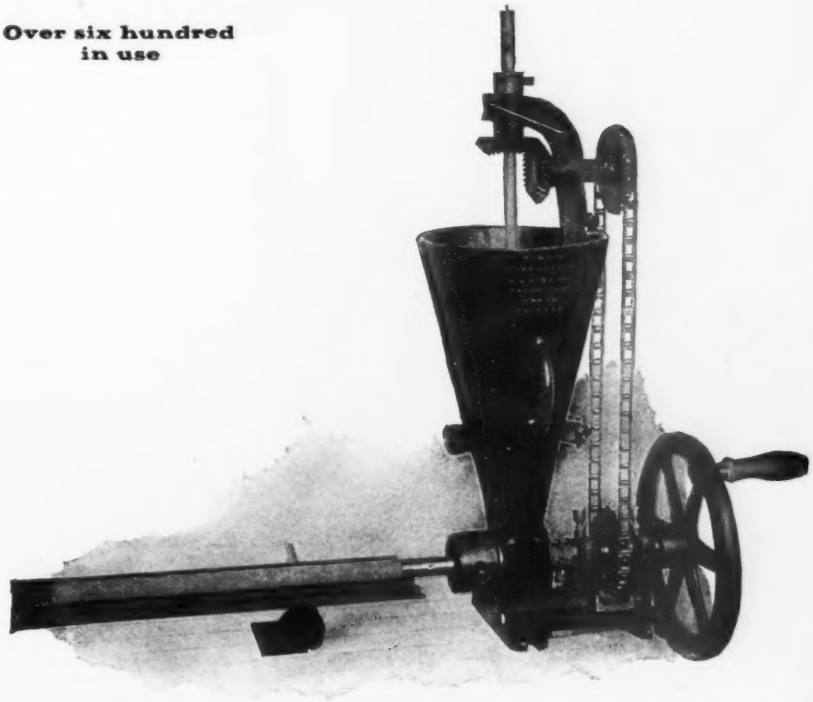
Hammer Core Machine

Makes perfectly round cores from
3/8" to 2-1/4" in diameter

Over six hundred in use



ADVANTAGES

No core boxes required	Less oven space needed
No ramming of sand by hand	Less fuel required
No uneven vent holes	Less breakage
No trimming or filing of cores	Less complaint from your customer

Send for catalogue and sample of core

BROWN SPECIALTY MACHINERY CO.

N. W. Cor. Jackson and Clinton Sts.

CHICAGO, ILL.

A BLOW TO PROFITS

Blow holes are a blow to profits when you have to throw away a casting because of them.

The same is true of cracks, uneven surfaces, crevices and the hundred and one other slight defects which make or mar a casting.

Clark's Metallic Filler

is a boom to profits.

It is a **cement** which fills in all holes, cracks, etc., and transforms your imperfect casting into a perfect one.

It enables your foundry to produce its fullest limit of castings per year, **and to make full profit on each** because you never have to throw one on the scrap heap.

Thus it pays for itself many times over.
The best proof of its value will be to test it.
Send for a free sample TODAY.

D. N. CLARK

Drawer 11 *Shelton, Conn.*

MODERN FLASKS

"Made a little better than seems necessary." It is a pleasure to work them.

IMPROVED RIB

FOR

BRASS FOUNDRIES.

LARGE STRAIGHT SIDE FLASKS

For Floor Work.

MOULDING MACHINE FLASKS

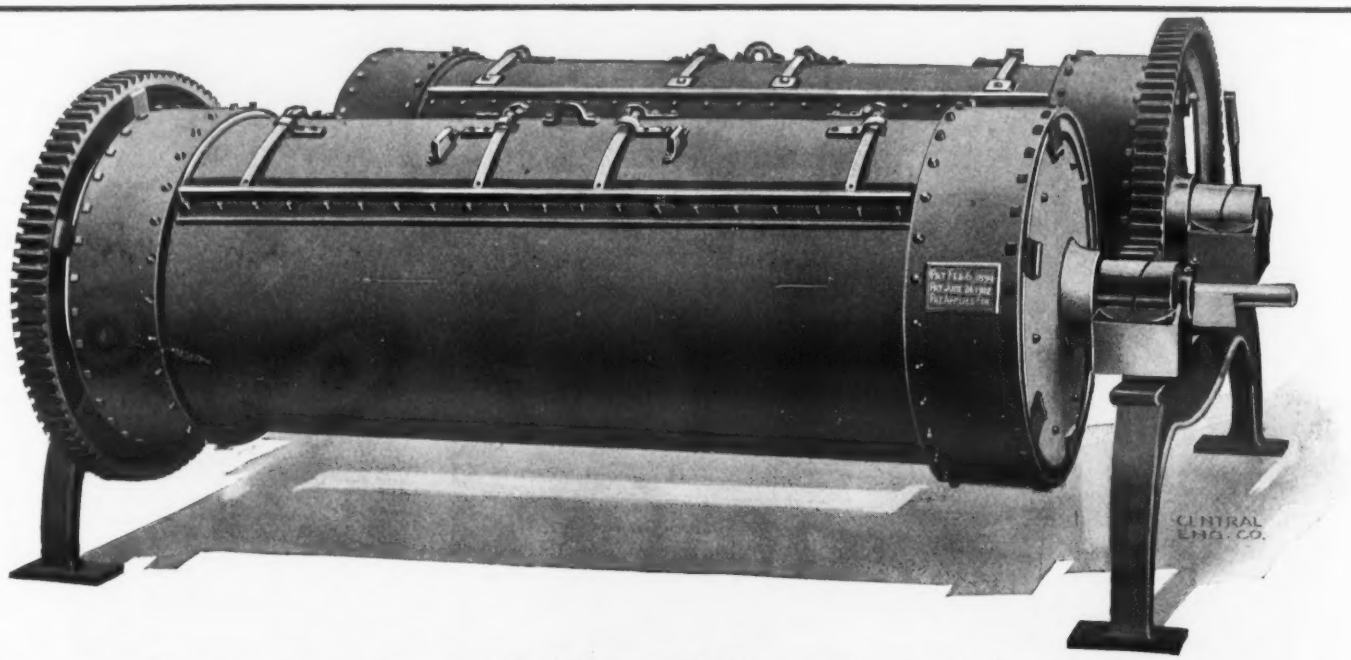
FOR

IRON, BRASS AND STEEL FOUNDRIES.

New issue—Complete Equipment for Brass Foundries—Cat. No. 12.

Brass Founders' Supply Co.

Newark, N. J.



A Set of our Special Mills for Milling Pipe with Flanges on same

GENTLEMEN:—

We wish to say to you through the Foundry that the first cost of our mills may be more than some others, but if you intend to stay in the foundry business, and wish your mills to give you long and good service, our mills are the cheapest on the market.

Our Mr. W. W. Sly is a practical foundryman, and is at your service. If you are contemplating a change in your mill room, we would be pleased to hear from you. Our Mr. Sly will call on you, and advise you in regard to the style and size of mills best suited for your work. We are constantly making improvements in our mills, one of our latest improvements, is a split steel pinion.

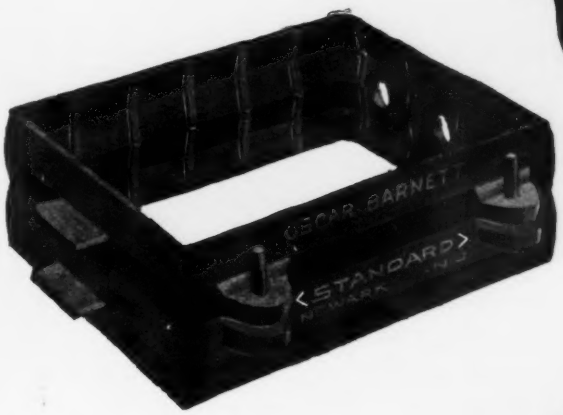
Trusting to be favored with an inquiry, we remain, yours truly,

The W. W. Sly Mfg. Co., Cleveland, Ohio

BRASS MOLDERS' FLASKS

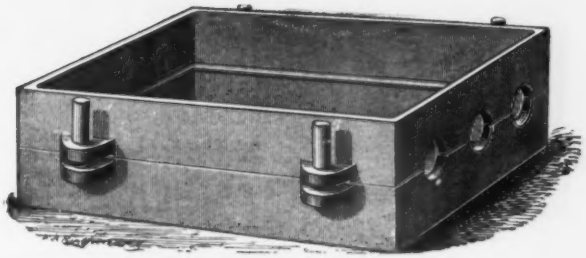
OF EVERY STYLE AND SIZE

Furnaces, Drying Stoves, Spill Troughs, Clamps, Boards, Tongs, Crucibles, etc., etc.



All our flasks interchange with any of same size made by us.

Our own foundries ensure prompt shipments



THE OSCAR BARNETT <STANDARD> FLASK

IS MADE ONLY BY

Oscar Barnett Foundry Co.

Founded 1845

NEWARK, N. J., U.S.A.

FOUNDRY IRON POINTERS

KITTANNING IRON & STEEL MFG. CO.

OFFICES	FOUNDRY and FORGE IRON and MUCK BAR	FURNACE and MILLS
Farmers Bank Bldg. Pittsburg		Kittanning, Pa.

EASTERN REPRESENTATIVES: N. S. Bartlett & CO., 126 State St., Boston, Mass.

MR. FOUNDRYMAN:

In producing a high grade foundry iron only the best material should be used. The furnace should run on foundry iron only, and all off iron produced should be sold as such and not shipped to the foundry trade.

In the production of REBECCA No. 1 and No. 2 only the highest grade ores from the old range in the Lake Superior region are used, and the coke is shipped from one of the best plants in the center of the Connellsville region. For years the REBECCA furnace has produced foundry iron exclusively, and all iron not meeting the REBECCA standard for the foundry trade has been sold as forge and off iron. No furnace producing Foundry Iron today, Bessemer tomorrow and Basic the next day, constantly changing its mixtures, can produce a foundry iron that will meet the exacting requirements of the foundry trade. Remember if a **soft** iron is desired specify REBECCA No. 1, for **strength** REBECCA No. 2.

There's Only One Furnace

Where foundry iron is made that is *always* the same. There they make

Cherry Valley Iron

The Brand of Certainty

The Brand of Satisfaction

The iron that for 28 years has been the standard for soft strong foundry iron.

The Cherry Valley Iron Co.

Pittsburg

"Pioneer" Foundry Pig Iron

Manufactured by

Pioneer Mining & Manufacturing Company

of

Birmingham, - Ala.

Is of the highest grade and always uniform. The ores and fuel used in its manufacture are entirely under the control of the Company and produced from their own mines adjacent to furnaces. If you use Pioneer Iron once, you will always desire to have it in your mixture. For prices write,

PIONEER MINING & MANUFACTURING CO.,

Birmingham, Alabama, or any of the following sales offices of the Republic Iron & Steel Company:

Chicago, Ill.
Cleveland, Ohio.
Cincinnati, Ohio.
Buffalo, N. Y.
St. Paul, Minn.
St. Louis, Mo.
Pittsburg, Pa.

William Sellers & Co., Incorp.

PHILADELPHIA, PA.

MODERN FOUNDRY MACHINERY

SAND MIXER

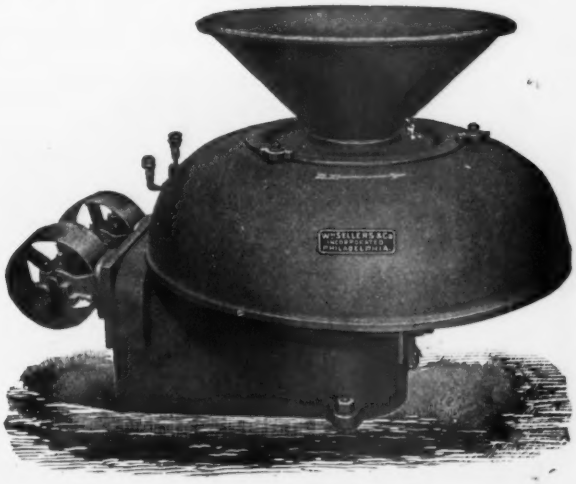
Not an Experiment

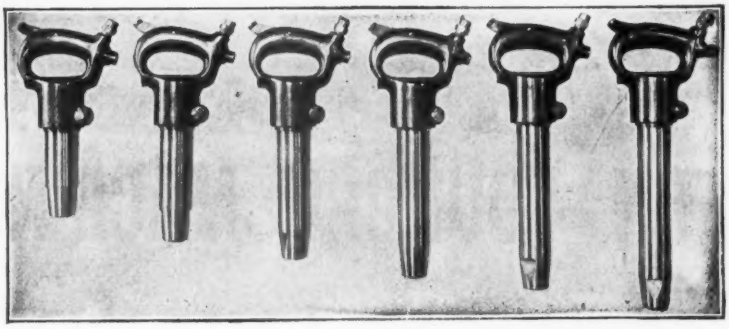
PRACTICAL
ECONOMICAL
EXPEDITIOUS

NOTE. — In order to clearly explain the **Modus Operandi** of this scientific and practical method of **mixing Molding Sand, Facing Sand and Core Sand**, we have issued a small pamphlet which will be sent on application.

TRAVELING CRANES FOR FOUNDRY USE.

Correspondence is Solicited.





Fast Riveting.

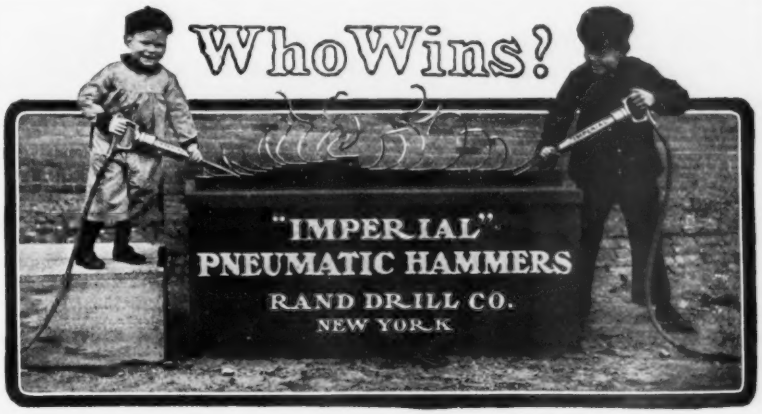
On bridge, ship-yard, tank and building work, a loss of seconds on each rivet means a loss of dollars on the day's work. For all such work

Keller Pneumatic Tools

are simply unequaled. In the great steel car shops they set a pace that no other tools can approach. This tremendous speed makes their work so much cheaper that their higher first cost is not worth considering. And they don't break down.

Write for our new catalogue and booklet on the "Care and Use of Pneumatic Tools."

PHILADELPHIA PNEUMATIC TOOL CO.,
21ST ST. & ALLEGHENY AVE.,
PHILADELPHIA.
NEW YORK CHICAGO PITTSBURGH
SAN FRANCISCO BOSTON



THE TIME AND LABOR SAVERS OF THE AGE

If Imperial Pneumatic Hammers can give complete satisfaction to users the world over, is it not possible that amongst our numerous styles and sizes there is one to fill your requirements?

We are convinced of the merit of Imperial Hammers, but to convince you they will be sent on trial and accepted back, we paying all transportation charges, if they fail to satisfy.

Chipping Castings with Imperial Pneumatic Hammers.

RAND DRILL COMPANY

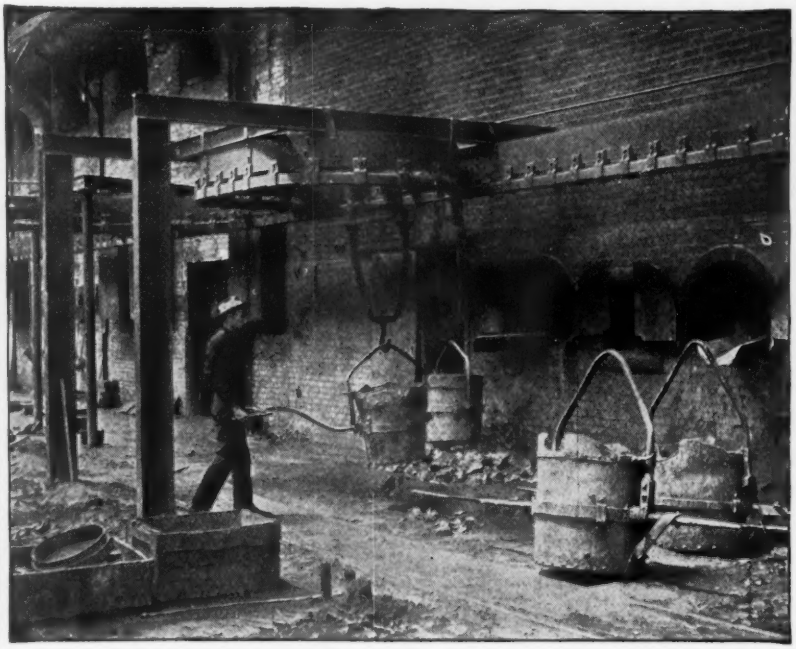
128 Broadway New York

BOSTON: 13 Pearl Street.
PHILADELPHIA: Stephen Girard Building.
ST. LOUIS: Lincoln Trust Bldg.
SAN FRANCISCO: 320 Rialto Building.

ELBOW GREASE

is the most expensive thing any foundryman can use around his plant. 'Twould surprise you how much of it a

COBURN TROLLEY TRACK



does away with. Moves Iron, Sand, Flasks, Coal—everything used in a foundry without the bother of clearing alleyways.

Tell us how your plant's laid out and we will tell you how to save money

COBURN TROLLEY TRACK MFG. CO.

HOLYOKE, MASS., U.S.A.

AVERAGE ANALYSIS

.78 Sulphur
.016 Phosphorus
10.68 Ash

Not of a few choice cars, but of thousands that have been shipped from our three plants

72-HOUR

Selected Connellsville

FOUNDRY COKE

All our Coke for the FOUNDRY TRADE is carefully made in 72-HOUR OVENS.

The drawing of each of these ovens is supervised by a competent foreman, whose duty it is to have only the best of each charge drawn for the exacting requirements of the FOUNDRY TRADE, rejecting any inferior material.

Every car is carefully loaded and the coke again selected, all bad pieces being thrown out. Owning our own cars we can always insure prompt shipments. It will PAY YOU to give our coke and service a trial.

OLIVER & SNYDER STEEL CO.

OFFICES:
PITTSBURG, PA.

OVENS:
In the heart of the Connellsville Region

EVERY FOUNDRYMAN

can avoid the loss and annoyance that comes from not having good cores ready when the molders want them.

MILLETT CORE OVENS

do away with all such troubles and are a source of constant satisfaction.

MORE THAN A THOUSAND

foundries have made their core rooms pleasant places to work in by using

MILLETT CORE OVENS

and have enabled their coremakers to produce the largest number of perfect cores at the smallest cost.

Let us know your needs

THE MILLETT CORE OVEN CO.

BRIGHTWOOD, MASS., U. S. A.

SALES AGENTS: S. OBERMAYER CO., Cincinnati and Chicago.
J. W. PAXSON CO., Philadelphia. J. W. JACKMAN & CO., London.
J. S. MCCORMICK CO., Pittsburgh.

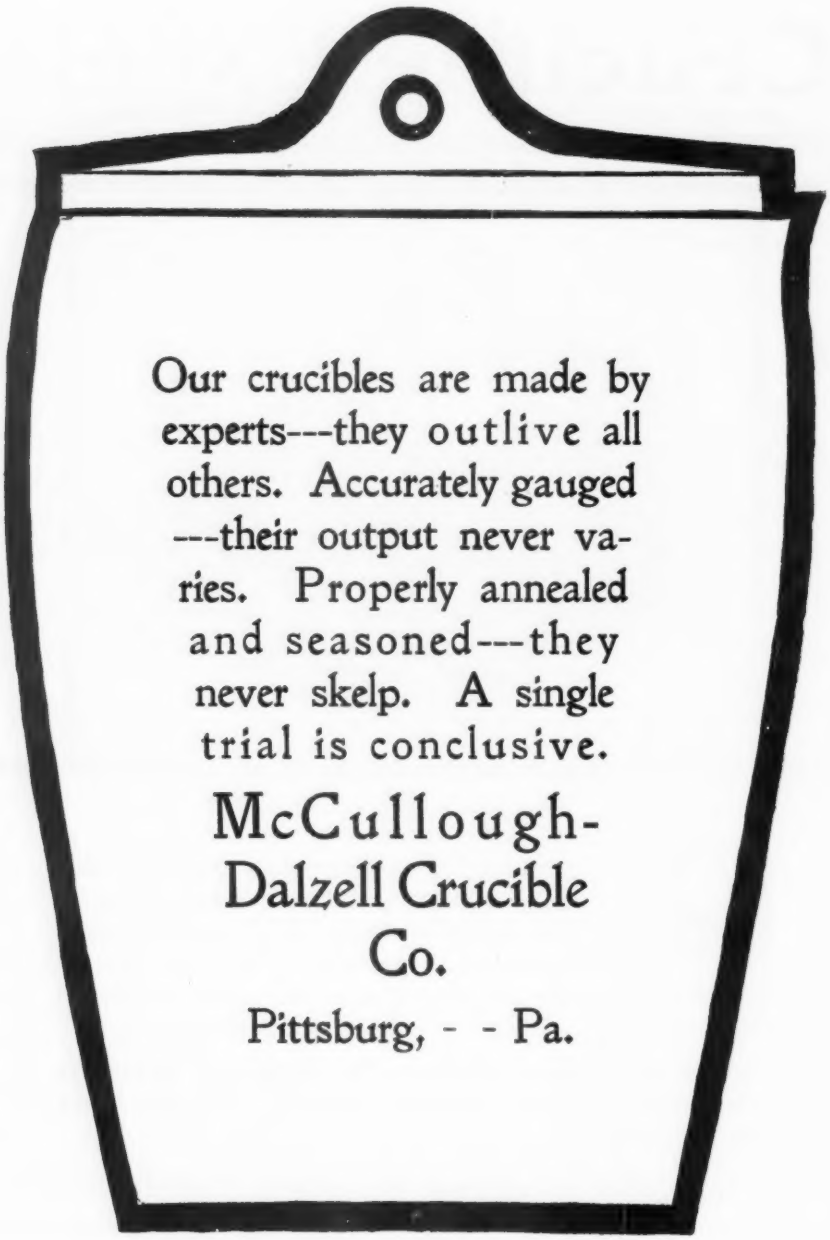
Why the Dixon Crucible Excels

THE value of the Dixon Plumbago Crucibles consists largely in the absolute adaptability of our several varieties for different conditions and character of melting. We can furnish each founder such a Crucible as will prove most economical for his particular fuels, fluxes and metals.

Is there any difficulty out of which we may now help you? If so, let us know.

Joseph Dixon Crucible Co.

Jersey City, N. J.


Our crucibles are made by experts---they outlive all others. Accurately gauged ---their output never varies. Properly annealed and seasoned---they never skelp. A single trial is conclusive.
McCullough-Dalzell Crucible Co.
Pittsburg, - - Pa.

This trade mark stands for the acme of crucible uniformity.

There's no guess work in the manufacture of a Taylor Crucible. Only the highest grades of material are used, and working strictly by our chemical analysis, we give a uniformity in the quality the year round, that is not approached.

A trial will convince you.

Robert J. Taylor, Incorporated

1900 to 1916 Callowhill Street

PHILADELPHIA, PA.

Two Five-Motor Electric Travelers. Capacity 35 tons each. Span 75 feet. Furnished Commonwealth Steel Co., St. Louis, Mo. Five Electric Cranes furnished above company.

ELECTRIC TRAVELERS

CRANES OF ALL KINDS

ALL TYPES

ENGINEERS, DESIGNERS AND MANUFACTURERS

COMPLETE EQUIPMENT FOR

GRAY IRON, CAR WHEEL AND PIPE FOUNDRIES

MALLEABLE AND STEEL CASTING PLANTS

1200 IN USE

Catalog "F" on request

WHITING FOUNDRY EQUIPMENT CO.

GENERAL OFFICE AND WORKS: HARVEY, ILL., U.S.A. (CHICAGO SUBURB)

THE FOUNDRY

Vol. 24, No. 2. *CLEVELAND, OHIO, APRIL, 1904.* *Whole No. 140*

Plant of the Acme Foundry Co., Cleveland, Ohio.

This plant is a good example of specialization along foundry lines. While they conduct a jobbing business, they have fitted up specially for light gray iron castings, and do not cater to trade requiring castings over one hundred pounds in weight. The plant presents a number of interesting features.

Buildings.

The buildings were designed and constructed by the Wellman-Seaver-Morgan Engineering Co. The main foundry building is provided with a saw tooth roof having sky-lights facing the north. The central bay opposite the cupola is provided with ordinary sky-lights in each side of a rather flat roof. In each one of the saw tooth roof sections there is a set of ventilators facing the south, the main sky-light facing the north being stationary. Slow-burning construction is used throughout.

The main building is 130 by 300 feet. The office is at present located in one corner of this building and the cleaning and shipping departments are also in the building adjacent to the office. It is intended at some future time to erect another building for these departments and to utilize the entire foundry building for foundry purposes. The power plant is located in a separate building and the core department is in a building forming a wing to the main foundry building. Across one end of the property is arranged a series of sheds for the storage of coke, fire-clay, sand, etc. The pig iron is simply stored in the open.

GENERAL VIEW OF FOUNDRY.

Molding Equipment.

The greater part of the floor is equipped with squeezer molding machines manufactured by the Adams Co., Dubuque, Ia. Most of the floors are 8 x 30 feet, though they have a few 9 x 35 feet. These latter floors are assigned to the men using the larger flasks or to men who usually put up an extra large amount of work.

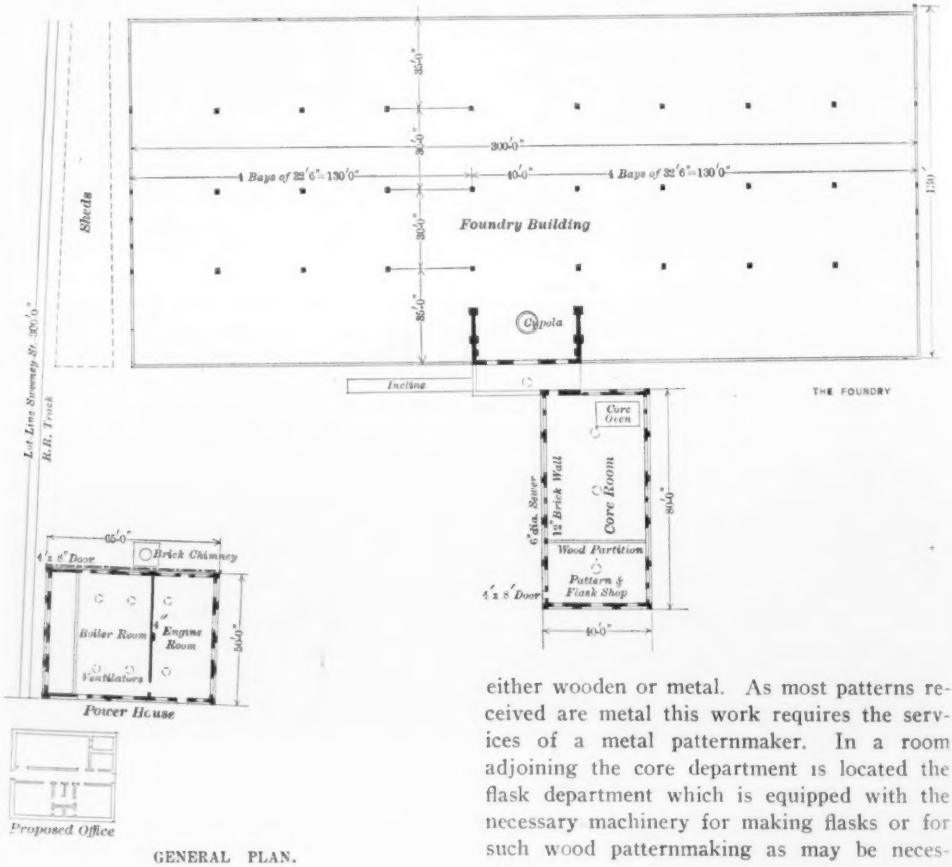
They have also a department devoted to ordinary bench molding and another devoted to floor molding for the larger castings.

Melting Equipment.

The melting equipment consists of a Whiting cupola 84 inches in diameter, lined to 66 inches. This is located in the center of one side of the foundry. Blast for the cupola is furnished by a Sturtevant blower driven by

an electric motor, the blower and motor being located on the charging floor. The iron, coke and other supplies required on the charging floor are elevated by means of an incline, up which a car is drawn by an electric winch. At the head of the incline there is a turntable which enables the car to be sent to any part of the charging floor where it is desired to pile the material. They use no foreign scrap in their mixture, the entire charge being composed of pig, together with their own sprues and return scrap. Practically all the iron is carried to the floor in hand ladles, each man doing his own pouring.

Any superfluous iron is poured into a pig bed adjacent to the cupola or into pig molds at the individual floors.



GENERAL PLAN.

Core Department.

The core department, as already stated, is situated in a wing adjoining the foundry. As most of the cores are small and many of them intricate, it is not practical to use core machines, and hence the department is equipped with benches and appliances for making the cores by hand.

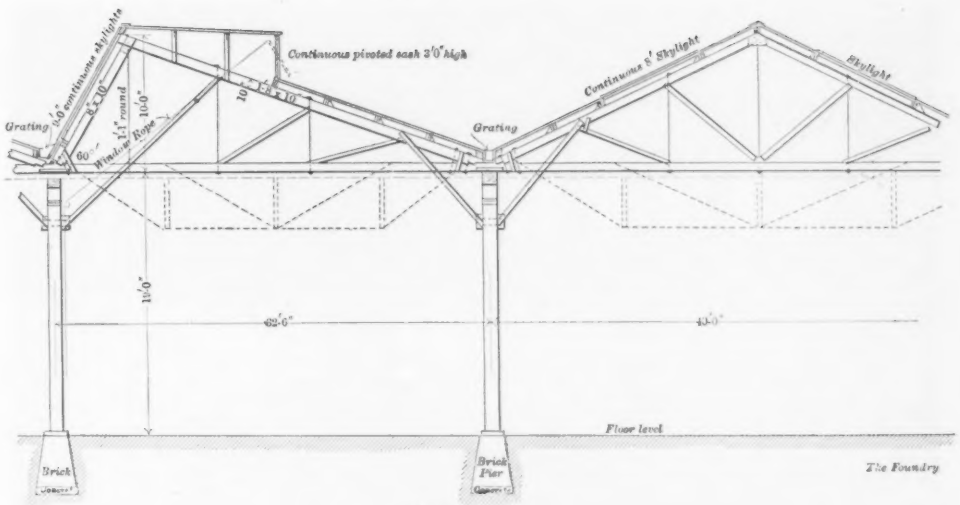
The drying equipment consists of a double oven, one-half of which contains stationary racks, and the other half revolving shelves or reels.

Pattern and Flask Departments.

As practically all of the castings made are from patterns furnished by the purchaser, they do not have to maintain a pattern shop, but in connection with the core room they have a department for the repair of patterns, either wooden or metal. As most patterns received are metal this work requires the services of a metal patternmaker. In a room adjoining the core department is located the flask department which is equipped with the necessary machinery for making flasks or for such wood patternmaking as may be necessary.

Pattern Storage.

For the storage of patterns they have a series of racks located in a room adjoining the cleaning department. The patterns and matches are located on shelves and are kept track of by means of a card index system. One interesting feature of their numbering system is that owing to the fact that the matches are mostly shallow, the shelves could be placed close together; but for the present they have been spaced fairly well apart and



SECTION OF ROOF.

only numbered with the odd numbers. If additional shelves are required they can be placed between the existing shelves and given even numbers.

Cleaning Department.

The cleaning department is situated across one end of the foundry and comprises a set of exhaust tumbling barrels of various sizes to suit different classes of work. They also have the necessary equipment of grinding machines, etc. As much of the work made is very small, it is necessary to have sorting benches for separating the castings from the stars used for cleaning them.

One interesting point in connection with the handling appliances used for handling the small

SQUEEZER WORK SECTION.

CENTRAL FLOOR IN FRONT OF CUPOLA: NOTE HEATING PIPES OVERHEAD.

FLOOR WORK SECTION.

MOLDING RECORD FOR _____ 190 ____

No.	Molder's Name	Pattern No.	Kind Casting	Time	Molds	Imp't	Broken	Good	Total Castings Broken	No. in Mold	Good Molds	Price	Amount	Total

The Foundry

RECORD BLANK FOR CASTINGS.

castings is that they have found iron barrels much more efficient than wooden barrels. While the iron barrels weigh about two and one-half times as much as the wooden barrels, they last much longer and the bottom of the barrel never falls out at an unexpected moment, thus seriously inconveniencing the workman.

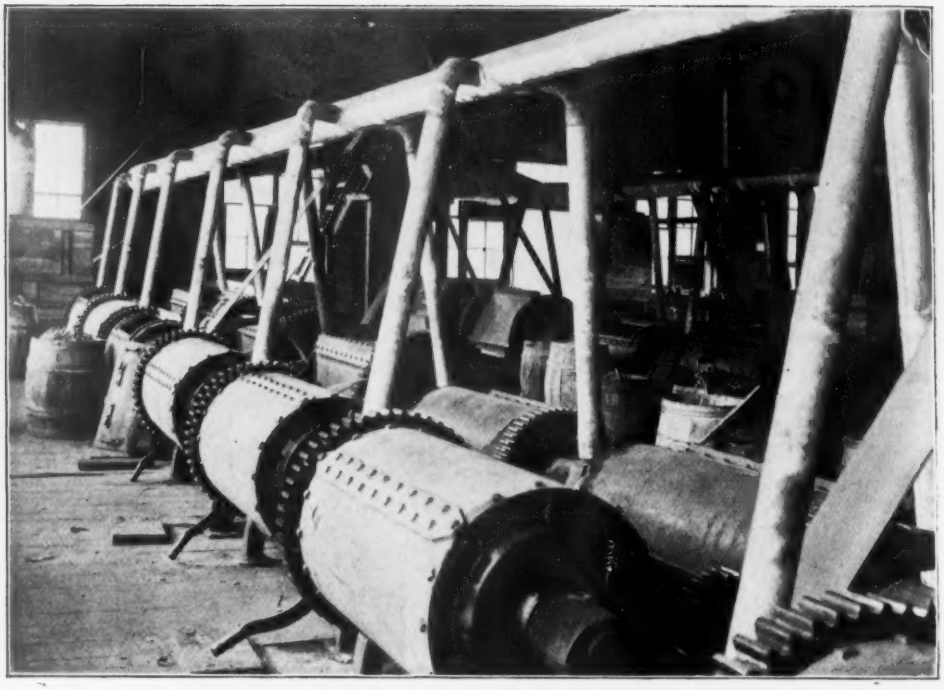
Heating Equipment.

For heating the foundry they have located some large stoves 60 feet from center to center. The stove pipes from these stoves run diagonally across the foundry to a central line of headers which join at the center and pass up through a large central stack. They burn soft coal in the stoves and the hot gases passing along the pipes and headers give up their heat. This has been found to be a very efficient method of heating. During the day one of the laborers has charge of the stoves and at night the care of them is assigned to one of the night men.

Casting Accounts.

Most of the men work at piece work. Each morning a sheet is posted on the molding floor which gives each man's name, number of molds, total castings, discounted castings, broken castings, and good castings. This en-

LOOKING NORTH, SHOWING SKYLIGHTS.



CLEANING ROOM.

TURNTABLE ON CHARGING FLOOR AT HEAD OF INCLINE. THE ELECTRIC WINCH IS BEHIND THE TURNTABLE.

INCLINE TO CHARGING FLOOR.

ables the men to check their work each day and thus avoid disputes on pay day. The men are paid for the good and broken castings. All discounted castings are laid out for the inspection of the men. The cores are also made piece work.

ANTIFRICTION ALLOYS.

BY JOHN F. BUCHANAN.

The history of the so-called Antifriction Alloys is the history of modern engineering, in miniature. In the days when the world and all its works went to the tune of "slow and sure," hot journals and squeaking axles were the signals for a halt; in the present day such untoward happenings are inexcusable. The market is glutted with antifriction goods—metals, greases, oils, etc., and the plurality of "best antifriction compounds" in these lines is, to say the least, embarrassing. It has always been an axiom in engineering that rubbing surfaces should be composed of dissimilar materials, in order to economize power and reduce the wear due to friction. Under the heading of antifriction alloys we must embrace two great classes of metals, viz.: Bearing Bronzes and the White Antifriction Alloys. The latter series is by far the most important to the general engineer, but we will deal first, and somewhat briefly, with the bearing bronzes favored by millwrights and locomotive makers from the early days of machine construction. "Brasses," i. e., bronze bearings, differ but little in composition from ordinary bronzes, but they are supposed to offer little frictional resistance when in contact with other metals. The best alloys in this group are characterized by hardness and strength; these qualities combined in a metal are found to resist wear, sustain pressure, and survive shocks. The Standard Bearing Bronzes range in copper from 82 to 88 per cent. Tin 12 to 18 per cent. These hard bronzes are still used by many prominent railway companies for axle boxes, truck bushes, slide valves, etc., but the investigations of recent years may truly be said to have disillusioned engineers regarding the old popular fallacy, that bearings should be made of the hardest mixture possible. In the early days of locomotive construction bearings were purposely made of an alloy harder than the steel or iron in the axle, crank shaft or journal. A mixture akin to bell metal (copper 84 parts, tin 16 parts) was termed "Box Metal," and faithfully used to cast axle boxes, because it was found to wear well; but with the development of high speed, high pressure engines, carrying heavier burdens, the friction increased at such a rate, necessitating frequent renewals of expensive forgings, that engineers were compelled to modify the hardness of the bearing alloy.

Nowadays it is the rule to have the bearing made of softer material than the journal, and the convenience and economy of repairs are found to be considerable. The same principle is applied in various ways in ordinary brass foundry practice, as for example, in casting the plug for a stop cock, or seat for a stop valve, a softer alloy is used than for the cock or valve, so that a longer life is insured, and after the wear of the plug has reached the limit, a new one may be fitted to the same barrel.

When phosphor bronze was first introduced as a practical alloy some thirty years ago, Kunzel recommended an alloy which has been highly successful for bearings, and the frictional parts of machines. The alloy referred to consisted of copper, 66½ to 91½ per cent; lead, 4 to 15 per cent; tin, 4 to 15 per cent; phosphorus, ½ to 3 per cent. It is worthy of note, that, the mean of these figures gives an alloy with proportions almost equivalent to the locomotive bearing bronzes in use on many of the largest railway systems at the present time

Several years ago the Pennsylvania railroad made an exhaustive series of tests with various combinations of copper, tin, and lead, in order to determine the best composition which would be suitable for its service, and the conclusions drawn from the experiments were as follows: (1) A simple alloy of copper and tin showed 50 per cent more wear than phosphor bronze. (2) The phosphorus plays no part in preventing wear excepting by pro-

ducing sound castings. (3) Wear increases with the content of lead. (4) Wear decreases with the diminution of tin. (5) Alloys containing more than 15 per cent lead, or less than 8 per cent tin, could not be produced because of segregation, but it was believed that if the lead could be still further increased and the tin diminished and still have the resultant alloy homogeneous, a better metal would result. A very common complaint against hard gun-metal as a bearing alloy is "tin spots," i. e., hard patches due to a localized excess of tin in the alloy. From the examination of the microstructure of bearing metals, Prof. Saveur has come to the conclusion that alloys of copper, tin, and lead, are superior to the hard copper and tin mixtures for friction-reducing qualities and durability.

A high place amongst bearing metals has been awarded an alloy containing approximately, copper 77 percent, tin 11 percent, and lead 12 percent. Arsenic bronze (that is, ordinary copper and tin bronze containing about 1 percent arsenic) has also proved superior to gun metal for bearings. The presence of zinc in bearing bronzes is undesirable; it increases the coefficient of friction and produces a fibrous condition of the alloy which necessitates careful and regular lubrication. Below we give a list of some favorite bearing metal mixtures, compiled from original sources:

Suited for	Copper	Tin	Lead	Phosphorus Copper	Arsenic	Manganese Copper
Bearings	85	11	...	4	...	...
"	80	8	8	4	...	...
"	80	10	...	...	...	10
Eccentrics	74	8	8	...	...	10
Pinions	16	2	...	1	...	...
Steam Cocks	100	12	12	...	...	...
Bushes	75	11	7	7	...	...
Slide Valves	70	10	3	7	...	10
Bearings	80	10	7	3	.80	...

While these alloys still occupy a prominent place in brass foundry practice, the white antifriction alloys have in great measure superseded them. To Isaac Babbitt, the inventor of the process of "babbitting" and of Babbitt's metal, belongs the honor of being the first to make practical demonstration of the utility of soft white metal alloys for reducing the friction of bearings and machine parts moving in contact.

Too much stress cannot be laid upon the fact that the patent for the "Babbitt bearing" preceded the patent for Babbitt's metal, as it was a greater innovation in the engineering practice of the time than the mere compounding of an alloy specially suited for bearings. A new principle in machine design, the interspacing of the bearing surface, was introduced, and it involved considerable inquiry into the laws of friction. Friction is a factor which has to be reckoned with in mechanics; it is a great dissipator of energy, and by it heat is produced.

Friction has been defined as "that force which tends to stop a moving body." The "laws" of friction as deduced from the experiments of Coulomb, Rennie, and others, present a complete and surprising contrast with regard to solids and liquids. With the former, friction is (a) proportional to pressure, (b) independent of area of contact, and (c) not greatly affected by the velocity of rubbing, while the reverse holds good with the latter. The friction of plane surfaces gliding over each other, which is the subject immediately under our observation, is influenced by the nature of the bodies in contact, and varies in the ratio of the weight and pressure of the rubbing parts, and the time and velocity of their motions. The ratio obtained by dividing the entire force of friction by the normal pressure is called the coefficient of friction. Or to put it another way, the coefficient of friction is the ratio of the force of friction to the force pressing the bodies together. The following are the average values with smooth surfaces on the several materials mentioned:

Metals on metals, dry	.15 to .2
Metals on metals, lubricated	.03 to .08
Metals on wood, dry	.3 to .6
Leather on metals, dry	.5
Wood on wood, dry	.3 to .6

Since the introduction of Babbitt metals, the co-efficients of friction have been considerably lessened. Numerous tests with various first-class Babbitt metals have shown the following averages: Co-efficient of friction 0.012, with load of 500 lb. per square inch and velocity of rubbing surface 500 feet per minute; compression on 1 cubic inch with loads of from 5 to 10 tons per square inch, 0.010 to 0.070; tensile strength about 4 tons per square inch; melting point 450° F.

The White Antifriction metals are now more numerous than the brasses and bronzes which they were originally intended to displace. "Babbitt metal" has about lost its individuality and the term has been applied to many concoctions which Babbitt would have disowned. Things have come to such a pass lately that

manufacturers have been compelled to classify alloys containing over 80 percent tin as GENUINE BABBITT METAL.

The components of Babbitt's original *antifriction metal* and the process of its manufacture are already too well known to need description, but a brief summary of the qualities sought after in alloys intended for antifriction purposes may help us to understand some of the causes of failure with haphazard methods of mixing or buying. The name "antifriction" metal is based on the fact that certain metals offer little frictional resistance under a heavy load when in contact with other metals. But it must not be thought that high-pressure capacity is the most important requirement in bearing metals. The speed, lubrication, conditions of running, and other factors are sometimes of greater moment than the mere burden which the bearing may have to carry. However, the characteristics of the White Antifriction metals, as a class, may be summed up thus: (1) They produce less friction and require less lubrication than any other class of metals or alloys. (2) Within certain limits they sustain great pressure without undue abrasion or compression. (3) They are generally sufficiently soft to adapt themselves to the bearing surface, and they do not readily cut the journal. (4) They are comparatively indifferent to the action of sea water, acids, etc. (5) They have low melting points and are easily manipulated. (6) They have small contraction, and they adhere well to other metals. In addition to the qualities necessary for ordinary antifriction metal, submerged bearings require to be somewhat neutral to galvanic action and must offer a high resistance to electricity.

With all these questions under consideration, it is little wonder that there is great diversity of opinion amongst engineers regarding the most desirable elements and proportions for antifriction metals. The white antifriction metals may be divided, for convenience in distinguishing them, into four classes, viz.: 1st, Genuine Babbitt metals, or those alloys having over 80 percent tin in their composition; 2d, plastic metals, or those best adapted for pasting purposes; 3d, antifriction metals, or those having lead as a base; 4th, white bronzes (so called), or those suitable for sand castings, generally having zinc for the base. This is by no means the accepted classification of these alloys, but they are growing so numerous that some such classification will soon be necessary.

Babbitt's metal, according to the formula for which the patent was granted, was a triple alloy, consisting of copper 3.7 parts, antimony 7.4 parts, and tin 88.9 parts. It was made by the good old-fashioned method of melting a portion of the components separately, producing what is known as "hardening," or "temper," melting the quantity of tin required to complete the alloy and adding in the necessary proportion of hardening.

The best alloys are still made in this manner, irrespective of the metal used as a base. The phenomenal success of Babbitt metal as a friction-reducing substance did much to promote the efficiency of modern machinery, and it was to a great extent instrumental in developing speed and economy of power. But no alloy made for a special purpose could be expected to possess the same properties under altered conditions, hence the call for modifications of Babbitt's formula to meet the views of progressive engineers and to keep pace with the economics of modern engineering. Much study has been given to the metals in their relation to friction. Some years ago Prof. Goodman made a series of investigations to determine the effect on the frictional resistance of minute additions of other metals, to a lead, tin and antimony alloy. He discovered that by the addition of from 0.03 to 0.25 of bismuth, the alloy acquired an almost incredible increase of antifrictional qualities, while a similar admixture of aluminum had the reverse effect. Some of the antifriction metals, though supposed to be the same, gave frictional results differing by as much as 100 percent. Analysis of the samples showed that the principal constituents were present in about the same proportions, but that there were differences in the amount of impurities present. Very minute quantities of some elements showed a marked effect on the friction—some increasing and others diminishing it—and further investigation proved that those elements of low atomic volume, $\left(\frac{\text{Atomic Weight}}{\text{Specific Gravity}}\right)$ increased the frictional resistance, whilst those of high atomic volume decreased it, provided that they were present in small and definite proportions.

The addition of .1 of aluminum, which has an atomic volume of 10.6, produced 30 percent increase in the frictional resistance, whilst the addition of bismuth, which has an atomic volume of 21.1, immediately reduced the friction. It would seem, therefore, that some elements, as bismuth, arsenic or phosphorus, have a bene-

ficial influence on antifriction metals, while other elements, as aluminum, iron or nickel, have a contrary effect. The following table enables us to contrast the properties of the metals in relation to friction:

Heat Conductivity	Hardness	Viscosity	Fusibility	Specific Heat	Atomic Volume
Copper	Antimony	Aluminium	Tin	Aluminium	Bismuth
Tin	Bismuth	Copper	Bismuth	Iron	Antimony
Iron	Iron	Antimony	Lead	Zinc	Lead
Lead	Zinc	Iron	Zinc	Copper	Tin
Bismuth	Copper	Zinc	Antimony	Tin	Aluminium
	Tin	Lead	Aluminium	Lead	Zinc
	Lead	Tin	Copper		Iron
			Iron		Copper

Assuming that the viscosity of liquids is conducive to friction, and low specific heat combined with fusibility and hardness are desirable qualities in lining metals, we have sufficient reason for considering that those metals which do not run freely, as aluminum, copper, zinc, and those which assume a pasty condition near to the point of solidification, as aluminum and iron, are less suited for reducing friction than metals possessing good flowing power, along with these other qualities. The benefits of arsenic in lead, phosphorus in bronze, bismuth in solders, and mercury in bismuth alloys or fusible metals, in increasing fluidity, and fusibility, are already well known, but the benefits derived by combining metals of high atomic volume and low specific heat and conductivity are not generally understood.

Taking the metals as arranged in the above table, a glance may show that if heat conductivity only had to be considered in selecting metal for antifriction purposes, bismuth, the poorest conductor of the series, would best meet the requirements; if hardness was the indispensable condition, then antimony would be the ideal metal, and so on through the table reading the columns from left to right.

The physical structure of metals and their chemical affinities combine to regulate the production of alloys conducive to the lowering of friction. Bismuth, we have seen, possesses many excellent qualities of this kind, but it lacks cohesion, and is therefore unsuitable as a base for a bearing alloy. Lead makes a good second to bismuth in three of the most desirable properties (heat conductive, fusibility and atomic volume), and but for its known softness, which causes it to spread and flow under pressure, it would, by itself, make a first-class antifriction metal. The antifriction alloys having lead for their base are daily increasing. They are hardened and have their melting points regulated to suit various conditions, by admixtures of copper, antimony, tin, bismuth or arsenic. In the words of an advertisement, "they have a graphite-like surface which is partially self-lubricating." Professor A. Humboldt Sexton declared at a public lecture in the Technical College, Glasgow, that the extraordinary success of the well-known "Magnolia Metal," was due chiefly to the combination in suitable proportions of the metals—lead, antimony and bismuth.

We have already seen that a very slight amount of impurity in the alloy used for bearings may increase the coefficient of friction and cause untold mischief. As all the commercial metals contain more or less impurities, it becomes manufacturers to guard against those elements which are known to increase friction, as aluminum, iron, nickel, and to be careful that the method of making up the alloys does not add to the content of impurities. Some firms announce that their metals "can be melted in an iron pot and they do not deteriorate by remelting." Such a statement is either an evidence that zinc or phosphorus are not contained in the alloy (if they were they would attack the iron), or else it contains one of those ingenious phrases put out by advertising experts to sell the goods.

Crucible melting is acknowledged to give the best results, and if large quantities are required, a furnace with a silicious lining is preferable. Enough has been said to show the need for considering the properties of the metals and the peculiar conditions which go to make good antifriction alloys.

The salient points to be observed in compounding antifriction alloys are condensed in what follows:

Some Pointers.

Antifriction alloys are better and more economically mixed by the "bath" system, or by means of "hardening," than by the direct fusion of the components.

They should not be heated to redness—the proper heat may be judged by inserting a pine stick; it should smoke or singe, but not burn.

If the alloys are overheated, antimony and zinc are decreased by volatilization, and a greater amount of separation of other constituents occurs in the process of solidification.

For all round excellence, genuine Babbitt metals are to be commended.

For a cheap metal to give good wear, alloys with zinc in the base give satisfaction, *if properly lubricated.*

For a metal requiring little attention at high speeds, alloys having lead in the base are the most suitable.

Plastic metals should contain little antimony, as that metal forms a grit on the bolt or pasting-iron, and prevents the flow of the alloy.

Aluminum and nickel are altogether unsuitable elements in antifriction alloys.

Beware of alloys whose virtues are advertised in the negative form.

A metal with a low coefficient of friction runs cooler and requires less lubrication than one with a higher coefficient.

The temperature of fusion is lowered by about 1-7 in ordinary practice; this is due to the pressure.

Traces of impurities have not the far-reaching effects in brass alloys that they have in gun metals or antifriction alloys.

Arsenic tends to crystallize other metals; it also promotes the union of other metals that would otherwise be difficult to mix.

Phosphorus prevents blistering, promotes fluidity and increases hardness.

Manganese is recommended for hydraulic machinery, or where chemical solutions give rise to corrosion with the ordinary alloys.

Powdered sal-ammoniac is the best flux for Babbitt metals.

Sawdust is a good protective for the alloys in the molten state.

A metal (not an alloy) which takes a high polish is better for linings than one which takes a dull polish. This would indicate the need for a close-grained metal.

Antifriction alloys are manufactured in three grades or degrees of hardness, to suit the varying load, speed and duty of machines. In testing the comparative values of alloys as antifriction metals, these things should be fairly considered. Oftentimes "destructive" tests are made in laboratories, with the object of fusing the metals by abnormal pressures and conditions. The conclusion to be drawn is that the metal which sticks or fuses first is the worse antifriction substance. This is hardly a fair test, as it neglects to consider the duty for which the metal is designed. The only practical test for such metals is the co-effiecient of friction in actual working conditions.

The early attempts to produce antifriction metals were mostly dual alloys—10 percent solutions of copper in tin, copper in zinc, antimony in tin, or antimony in lead; but the limitations of these alloys were far from satisfying the general requirements. Dual alloys, therefore, are an unimportant class, entirely out of favor, except in one or two special cases, as lead and antimony, called antimonial lead, for submerged light bearings or chemical plant, or tin and antimony, for gas plant machinery. An example of the latter used by a large firm of meter manufacturers is composed of tin 75 parts, antimony 25 parts. For light machinery running at ordinary speeds an alloy of lead and arsenic, known as "shot" metal, makes a splendid antifriction metal. The following table gives a selection of the best alloys derived by analysis or from the formulas of the makers. These alloys are all of proved excellence, and, although they have not been set down in the order of their merit, they have been selected from the very best authorities and practice in the engineering world.

	Copper	Tin	Antimony	Lead	Zinc	Bismuth	Name.
1	3.8	78.56	11.8	6.0	...	...	Navy Bronze No. 1
2	8	83	9	...	...	...	Admiralty Special
3	1.80	64.70	...	1.0	33.35	...	Parson's
4	4	35	17	44	...	...	Navy Bronze No. 4
5	7	80	2	10	...	1	Plastic Metal
6	...	18	2.5	4.5	75	...	White Brass No. 1
7	3.64	22.14	...	...	74.22	...	White Brass No. 2
8	...	42	12	46	...	...	Lining Metal
9	2.50	...	16.43	80.24	...	0.76	Universal Bearing Metal
10	...	48	4	...	48	...	Marine Bronze

The Root Bros. Co., of Plymouth, O., whose foundry was recently destroyed by fire will replace it with a larger building which will be equipped with the latest improved machinery. In the meantime arrangements have been made to rent a foundry at Sandusky, O.

The Union City Foundry Co., Union City, Pa., who are building a foundry 50 x 105 feet, also a machine shop, pattern shop and other buildings have ordered machinery for equipping their plant.

The Champion Blower and Forge Co., of Lancaster, Pa., has purchased three acres of land upon which it will build a new foundry.

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TRADE OUTLOOK.

The general trade outlook is much brighter at present than it has been at any time since the first of the year, and it is to be hoped that the strengthening of prices and general revival of business is permanent and not simply a temporary upturn.

The rate of consumption of pig iron is probably slightly in excess of the production and hence stocks on hand are being decreased even though there are more furnaces in blast than there were a month ago. It is stated that the stocks, apart from those in the hands of steel companies, were reduced nearly 50,000 tons in February. The steel companies have purchased a large tonnage of Bessemer. The pig iron production is now practically the same that it was in March, 1902. The Southern furnacemen have been active, though most of them have sold their output for some time in the future and the price has gradually advanced from $9 at furnace until now $9.50 is the lowest price that any are willing to consider, and some are holding for $10 on No. 2 foundry.

Northern irons are commanding a higher price, and $12.50 at the furnace is usually the minimum for No. 2 foundry, while $13 is frequently quoted. Most jobbing and manufacturing foundries have not as yet followed the pipe, radiator and other special lines in covering for the first half of the year, though several of them have purchased a supply for 60 days in advance, and a few have covered their requirments for the entire year. Inquiries are being received by the furnacemen contingent upon different foundries securing contracts for some of the Pennsylvania railroad castings. It is now practically certain that these castings will require 100,000 tons of iron during the coming year and the same amount in each of the two following years, and hence they are becoming a factor in the market.

The railroad companies are about the only ones that have not placed orders for castings with a fair degree of freedom. The railroads however, are purchasing locomotives, and it is to be hoped that they will place orders for other classes of supplies before long.

The price of coke has advanced from 15 to 25 cents a ton and a good many foundrymen have had difficulty in securing prompt shipments, owing to the lack of cars. It is now certain that there will be no coal strike and hence it is to be hoped that all lines of manufacturing will soon be in a more settled condition. General readjustments of the wage scale have been going on in the different divisions of the iron and steel industries and this will tend to steady conditions and increase the number of men employed.

THE SIZE OF CRUCIBLES.

There seems to be considerable confusion as to the meaning of the term "size" in the crucible business. The universal understanding has been that the crucible should hold three pounds of melted copper per number when level full. It is evident that some crucible makers are not following this. Many changes have occurred through the introduction of special crucibles to satisfy certain customers, for instance, if a crucible is made the same diameter as No. 60 but somewhat deeper, it might be called No. 60 special. After awhile the firm ordering it would drop off the "special," but the house furnishing it would know that that firm always took the special.

Later, for some reason, crucibles would be ordered from another house, or by some accident the regular crucible would be sent in place of the special, and this would result in trouble at once. Crucible users would certainly be working to their own best interests if they would insist on a uniform standard of numbering crucibles.

Anyone can test the size of a crucible by varnishing its inside, filling it with water and weighing it both empty and full. The difference between the weight of the empty crucible and the crucible full of water would be the

weight of the water contained, and this multiplied by 8.8 will give the weight of copper which the crucible would hold under similar conditions. A crucible to hold three pounds of copper per number should contain .34 pounds of water per number.

A New Metal—Nodium.

United States Consul General Gunther, of Frankfort, Germany, sends the following:

A new metal which is similar to aluminum, but still of less weight, has been discovered by the French Engineer Albert Nodon and called nodium after him. In color, luster and structure it is almost exactly like steel. It is manufactured by an electric process. Its specific weight when molten is 2.04. Its resistance against breaking is given as about 20 pounds per square of 0.04 inches. Its ductility is between 6 and 8 inches. Its malleability can be compared to that of bronze. It melts at about 600 degrees. It is suitable for being cast into forms. The electrical conductivity is as high as that of copper of equal weight.

Where electricity generated by water power is available, it can be manufactured for about $.15 per pound. The inventor expects nodium will be used for many commercial purposes in the near future. Nothing definite has yet been communicated as to the chemical composition of nodium, nor as to the mode of its manufacture.

POINTS FOR BRASS FOUNDERS.

BY A PRACTICAL TRAVELING MAN.

Well, you are just the man we have been looking for. Now tell me how you would figure on a job like this one. Here is a man who wants 1,000 castings in a big rush and only furnishes one pattern. It will take a run of a thousand flasks to get the job done. My molder only puts up 52 flasks for a day's work. So without losing any castings it will take 20 days to complete the order. Now you have my position clearly stated. What would you do?

Why, make duplicate patterns, take that 11 x 14 flask of yours and you can get 10 of those patterns in it easily, then you can do up the job quick, you can finish the order complete in two days after you get your patterns ready.

Just ram up 10 of your small flasks from this one pattern, rap it well in the sand, be sure and cut a large gate and runner. Then pour, in this non-shrinking white pattern metal 50 parts tin and 50 parts spelter. If you are careful in molding you can clean the castings up good enough for use with a scratch brush and a rough file. After drilling your draw holes make a match side in green sand that will be good enough for 100 molds; or better yet, you need not pick out each pattern. You can roll the patterns out just as well. After lifting your cope put back your match side and roll the patterns from the drag or nowel. This saves time and there is not so much patching up of the molds necessary.

Then you can get this order out in two days. Your customer will be surprised and wonder how you did it, and from my knowledge of human nature, will do you some good in advertising you as up-to-date.

If the job is to be a standard or permanent one, just fix up for the job in a perfect way. Have gate and patterns cast all in one piece. Make an odd side that will last a long time, using the following formula: Dry molding sand, 6 parts; boiled linseed oil, 1 part; litharge, ¼ part. Mix well together, rubbing with hands and working through a ¼-inch riddle. Use it just a little drier than your molding sand. Have match frames with grooves inside to hold the sand. Make them just deep enough to cover the patterns properly, as it is better for the molder if the odd side is light; easy to roll over; molder not so tired; *more work*. Good tools always pay for themselves double, and production is what counts.

How about aluminum for patterns? They are just fine. Make Jim Dandies nice and light. But they must be finely finished, and they cost more money. All right if you can get your customer to furnish you with patterns, get the very best, either brass or aluminum. But for a rush job and good quick work, nothing like white metal. Then it is something you can always find use for, when the old patterns becomes obsolete it makes good mixture for red brass. Guess you will have to excuse me, my train leaves for the West at 3:40. Don't want to lose it. If nothing happens expect to see you again next month.

The National Steel Co. will construct a new foundry building at Fair Haven, Conn. The plans call for a building 165 x 410 feet.

The Standard Stove Works, of Fort Payne, Ala., have constructed an addition to their foundry which will enable them to employ about fifteen more molders.

FAN POWER FOR THE CUPOLA.*

BY THOS. D. WEST.

Recent experience in installing a large new fan and power to run it has impressed the writer with the importance of a more definite basis for purchasing the necessary power to run foundry fans. The fan, which, by the way, is a very good one, was purchased to blow a cupola 66 inches inside lining. The power required was given as 45 h. p., but in order to have a surplus we obtained a 75-h. p. motor. In starting to use the fan all connected to the cupola, we found it required 92 h. p. to give 1,735 revolutions, which was within 300 revolutions of what the fan should run to give its greatest volume of blast. Being afraid of burning out our motor, we at once wrote the fan people and had a man come to investigate the difficulty. He started in by stating that a fan required the greatest power when its gate was closed and criticised points in our piping which we were unable to have different at that time and of which not a word was written by the fan people when we were making inquiries of them as to the power required. We held the position that the motor power was entirely too light for the fan, no matter how the blast pipes were arranged, and asked him to take a test with the fan outlet free of all piping and wide open, as we did not agree with his claim that a closed outlet required the greatest power. This test, which we ran with 1,400 revolutions, took about 115 h. p.

The expert, thinking to evade the issue, offered to replace the 75-h. p. electric motor with a 50-h. p. steam engine and guarantee it to do the work, if we would furnish the steam; but knowing by the current record accurately what power we were using every minute (something we could not readily test ourselves with steam power), we of course ignored such a proposal.

Since there is now no accepted standard of power to run fans, I hold that the buyer or user should know the power required to run his fan when the outlet is open and closed. This is the greatest and least power that can ever be demanded, as can be seen by tests Nos. 9 and 10, Table 1, and is the only intelligent basis upon which to compile tables.

When a fan or blower leaves the manufacturer's shops, it may go to a plant where conditions as to length and shape of piping, distance of cupola, character of tuyeres, difference in charging of iron and fuel, also their character, will vary greatly from the conditions at any place to which its duplicate may be shipped; and thus the exact power required will be different in every case. If one writes today for information on the efficiency of fans, he will likely receive tables showing that certain revolutions will give a certain volume and pressure, and these latter will bring down so much iron per hour, but not a line about the horsepower required. Should results not tally with what the tables call for, when you get your fan at work, and you write a complaint, you may receive a confusing letter in support of the fan tables and claiming that you have something very unusual in your practice. Be this as it may, you are in trouble that could have been avoided had you the base for a standard herein suggested.

If we can know the maximum power that is likely ever to be used, as in the case of an accident rupturing the pipe adjoining the fan, and also know the least power required, as in the case where tuyeres are badly bunged up, or the fan wheels are cutting the air, as in test No. 10, Table 1, we have two positive factors for a standard that can be definitely and satisfactorily used at the maker's and buyer's shops alike. And this without considering or including a lot of variables that cannot offer anything conclusive and only give cause for contention over conditions that are never alike in any two shops.

The power that is required in the everyday use of a fan or blower will vary greatly from that required to run them with open and closed outlets. Some fans can be found 100 to 200 feet away from their cupola, and as full of bends as a ram's horn, while others will be within a few feet of their cupola, with few if any bends in the piping. Of course, the shorter the piping and the fewer the bends the less power required to drive the fan or blower, and the better the service rendered. As an example, we reduced the load on our fan motor about 20 h. p. by moving our fan 15 feet nearer to our cupola and dispensing with two curved elbows as soon as conditions permitted the change. This is only one of the many conditions that vary and that call for a great difference in the actual power required between what a fan will need to run with open and closed outlet.

Some manufacturers of fans and blowers will no doubt object to stating the power necessary to run them open, on the ground that

*Read before the Pittsburg Foundrymen's Association March 7, 1904.

this calls for more than will be used. This is true in most all cases, but it should not prevent them publishing such data at different speeds for a base to figure from.

As suggestions for rules to provide sufficient power for actual everyday practice from the base of power required to run a fan open and closed, I would subtract the power required to run a fan closed from that required to run it open at any desired speed. For example, we present the following from tests Nos. 9 and 10, Table No. 1.

Maximum power with speed 1800 r. p. m. and open outlet..... 144.6 h. p.
Minimum power with speed 1800 r. p. m. and gate closed..... 37.2 "

Maximum power required in actual practice, speed 1800..... 107.4 "

A second rule would be to provide a power equal to 75 percent of the maximum load with open outlet at any desired speed as follows: 144.6 — 36.15 = 108.45. One rule gives us 107.4 h. p., while the other gives 108.45 h. p., a difference of about one horsepower. These are rules which could greatly improve present methods, and such as the buyer could test as well as the maker.

Users of all steam power connected with other machinery than their fan rarely know what power their fan is using. If the boiler or engine is found overloaded, the excess over calculations is generally charged to other tools, as the fan people had stated the exact power required. Of course there is a way to indicate the steam power used, but the inconvenience and often expense of such tests prevents many from having this done.

By the use of electricity one can readily detach machinery other than the fan to find at any moment just the power it requires. This modern method demands most exact knowledge of the actual power a fan requires. Had we shut our eyes to the amperes recorded, or placed full confidence in the instruction of our fan maker, we could have ruined an expensive motor in short order and shut down our works for many weeks to wait for a new motor, all at a cost of hundreds of dollars besides loss of customers.

The foundry business, by the aid of foundry literature, is coming more and more to scientific lines and we should possess a knowledge of the principles involved in the supplies we purchase, as well as of the manipulations on the floor and in the cupola.

TABLE NO. 1.

POWER AND PRESSURE TEST OF FAN BLAST, TAKEN JAN. 23, 1904.

No. of Test	Time	R. P. M.	H. P.	B. P.
1	8:00 a. m.	1800	120.5	5 oz.
2	10:00 "	1800	101.0	10 "
3	12:00 "	1800	76.7	11 "
4	1:00 p.m.	1800	75.4	12¾ "
5	2:00 "	1800	75.4	13 "
6	3:00 "	1800	70.8	12 "
7	4:00 "	1800	70.8	11½ "
8	5:00 "	1800	70.8	11¾ "
	5:30 "	Bottom dropped		
9	Open outlet	1800	141.6	
10	Closed outlet	1800	37.2	15 "

Blast Pressure Gauges.

There are few things for use in a foundry that are more deceptive if not thoroughly understood, than blast pressure gauges. This is owing chiefly to the fact that any increase in the power to run a fan will not always produce like increase in blast pressure, as is seen by a study of Table No. 1. Here we find that with the exercise of the greatest power or blast volume, we have the lowest pressure and with the least power and creation of volume the highest pressure, thus giving us results in pressure the opposite of what we should expect, from the increase of power. In other words, pressure is often more due to resistance of delivery than to the power used to create the volume. This seeming inconsistency is due to friction in the pipes and conditions of the stock in the cupola, especially that fronting the tuyeres. To demonstrate this was one reason for the tests shown in Table 1. These it will be observed were obtained by maintaining a constant speed and making the power to run the fan the variable.

In using a blast pressure gauge, the pipe which first receives the impetus force of the moving blast should be placed at a point where the blast strikes with the most direct force, as at some turn, instead of the straight pipe where there is a more rapid moving action. A good plan is to insert a curved pipe in the main pipe, with its opening in a direct line with the main pipe or moving air, so as to have its force exerted squarely against the opening of the pipe which leads to the pressure gauge.

Test No. 1 was taken after the sand bottom was put in and with no fuel in the cupola, so as to leave free play for the blast through the cupola tuyeres. Here we have the freest liberation for volume of blast that is possible outside of disconnecting the pipes from the fan's

outlet and blowing into the open air. In this test the fan requires 120.5 h. p. and we get but 5 ounces of pressure.

Test No. 2 was taken after the kindling and coke for the bed had been fired. We ran but a few minutes, for fear of blowing out the fire. Here, owing to the tuyeres being checked to a greater or less degree by coke, we find the pressure increased to 10 ounces.

Test No. 3 was taken about 5 minutes after starting the blast to melt down the iron, and gave a pressure of 11 ounces.

Tests No. 4 and 5 give us the highest pressure obtained during the heat and the only way we can explain the lower pressure further on is that after the fifth test the tuyeres must have burned out and become freer or it may be that the iron was larger or not charged as close as when the men were fresh at the beginning of the heat. This irregularity in tuyere freedom appears in all long heats.

Test No. 9 was taken next morning by removing all piping from the fan outlet. Here we find 144.6 h. p. being required as against 37.2 when the gates were closed after connecting the pipes, a difference of 107.4 h. p. This shows the great difference required in power between forcing blast into the open air and against bunged tuyeres. Many have supposed that the more the tuyeres were bunged up the greater the power required to drive a fan. The reverse is the case. Test No. 10 is also interesting in showing the greatest blast pressure the fan is capable of producing—when it merely revolves to cut the air. The tests of Table 1 give much that should be of value to all interested in blast production.

It is not to be taken from what has been stated that we wish to advocate the abandoning of the blast pressure gauge. It is valuable as a comparative index of the pressure different fans and blowers can create under like conditions. It is also useful to indicate at the commencement of a heat if we are starting off with the pressure that experience with any particular fuel or conditions has proved best for use, and later at any period of a test what volume of air is being delivered into a cupola, providing we use a speed indicator to observe the revolution of our motors or fans.

I wish to emphasize the importance of such a tool, as by its use we can tell better what volume the fan should deliver into our cupola providing there were no obstruction. What effect this obstruction has produced, as in the case of bunged tuyeres, we can fairly judge by the pressure gauge, and thus be better able to decide whether it is the want of blast or some other factor that prevents our obtaining the expected speed in melting.

The Question of Blast Volume.

It is said to require about 33,000 cubic feet of air to melt 2,000 pounds of iron in ordinary cupola practice. The more evenly this air is distributed throughout the fuel in a cupola the better economy and speed in melting. While combustion only demands volume of blast, we are compelled to utilize pressure in order to force the air into a cupola. It would be better if we could dispense with pressure entirely, but when we consider that the volume of air necessary to melt a ton of iron weighs about 2,851 pounds at 0° Fahr., which is much the temperature we have in winter, and about 2,419 pounds at 82° Fahr. in hot weather, we more fully realize the necessity of pressure to drive air into a cupola.

The greatest pressure a fan gives us is about one pound per square inch, whereas in blast furnaces we find 10 to 30 pounds pressure per square inch being used. When we consider that the bottom stock in a furnace which is so pliable or plastic through heat as to pack closely, has a weight of 200 or more tons of stock—generally no coarser than coke, the ore often being as fine as molding sand—bearing down upon it, we can appreciate why a furnace requires such high pressure.

In a cupola we have pig iron and scrap to take the place of fine ore in a furnace and instead of stock ranging from 60 to 80 feet high, as in furnaces, we rarely exceed 10 feet, thus again showing us why there should be such a great difference in the pressure required between furnace and cupola practice.

We have stated that pressure could be dispensed with, and that it is volume that is really wanted; but as we cannot obtain the latter without utilizing the former we should look sharply to it that we get all of the pressure necessary to force the volume into our cupola and the more the air is driven to the center to give uniform distribution of blast, the better. While our present makes of fans and blowers will give but about one pound pressure and then cut the air, we can by close charging, having large tuyere area, and keeping tuyeres open, greatly assist the blast to penetrate more to the center than is otherwise possible. With a small cupola this is not difficult, but with those above 60 inches inside diameter a "center blast tuyere" is very bene-

ficial as we have found by using one for eight years past in our foundry.

This paper would be incomplete if we ignored the relation of blast to different densities of fuel. As a rule the more dense or solid the fuel the greater volume and pressure required. As an example, 48-hour or soft furnace coke is best blown with one-fourth to one-third less blast than 72-hour or a solid, hard foundry coke. The evils of blowing any fuel with a stronger blast than is required lie in a destruction of fuel and lining, creation of foaming slag, and early bunging up of the tuyeres.

More depends on using the proper volume and force of blast to suit the different densities of fuel, in aiding successful melting, especially in long heats, than many realize. It is a feature of cupola practice that should be well studied until one finds what is best in his own particular cupola. Full knowledge on these points and watching them carefully at every heat will tend greatly to good melting and full clean bottom drops in cupola practice.

SEPARATE ORDER COSTS.

BY R. W. MACDOWELL.

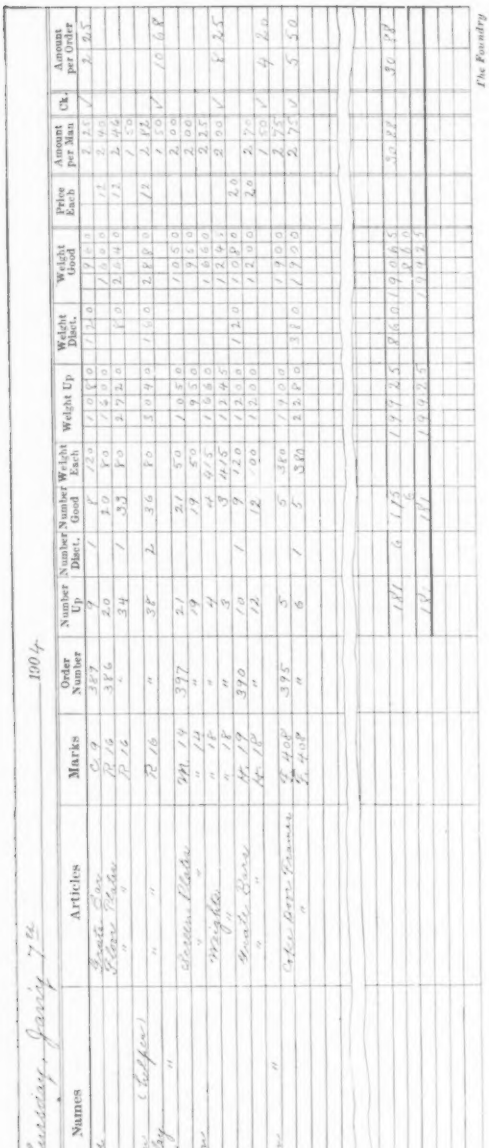
Some months ago the writer was called upon to devise a plan for a small foundry, whereby they could figure out the separate cost of each order they got out. Their previous efforts in this line had been rather unsuccessful, chiefly owing to the difficulty they had experienced in finding just how much labor had been expended on each order. The foundry in question made a general line of castings, running particularly to such work as coke oven door frames, grate bars, frogs and turnouts and such other castings as are commonly used around a coke plant. Their patterns were bought from outside sources and did not enter into their manufacturing costs proper.

The orders were, of course, begun and finished at different times, and it was manifestly impossible to keep all the men at work on one order at the same time. If this could have been done it would have been a comparatively easy matter to have kept record of the total time expended between the start of an order and its completion, charging all such time to this order. But this being out of the question, it became necessary to obtain a method by which the time spent by each molder on the various orders could be definitely determined, after which the expense of cleaning and non-productive labor could be pro-rated to the amount of the productive labor, thus getting at the actual cost of the work very closely. The amount and cost of the material was, of course, known, so it was not difficult to figure the total cost of the order after the cost of the labor was known. It is a very hard proposition, and is not advisable to attempt to compel the molder to keep record of his work, as the average molder wants no bookkeeping that can be possibly avoided, and any records gotten from him are not, as a rule, to be depended upon. So the principal requisite was to find some way of getting the required information without in any way depending on the molder to furnish it. This was welcomed by the men, who had previously been expected to fill out sundry blanks giving their time on various orders, with a description of their work.

The first step necessary was to finish up as many of the orders on hand as possible, so as to have as many men at work on one order as could conveniently be employed on it, thus keeping down the number of separate orders in the foundry at one time. The next thing was to arrange a production sheet which would show not only the number of castings made each day, with their weight, but also the time of each man, the order he worked on, and the total time on each order for the day. This was made up as shown in Form 1.

The men's names and numbers are entered in their proper columns on the left of the sheet, followed by a description of the work they put up for that day. This information is obtained from the foreman's report, Form 4, which is made up and handed in each day. The order numbers are filled in by the timekeeper, who finishes up the production sheet after the work comes out of the cleaning room. The method used here is almost identical with that described in a former article on "Pay Rolls and Timekeeping," so will not require any further description.

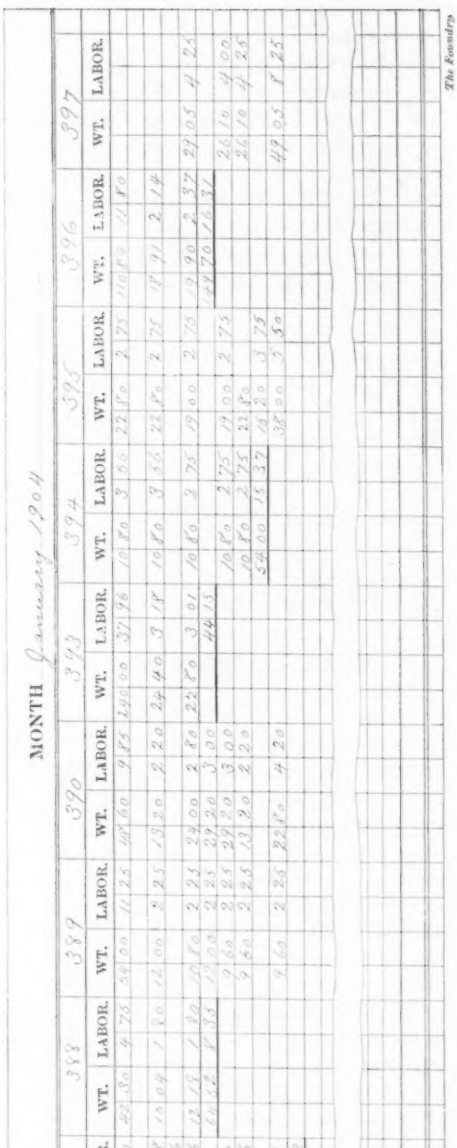
After the production sheet has been filled out, the costs of molding and material on each order are entered on the cost sheet, illustrated in Form 2. The weight of the castings is figured at a certain price per pound and entered in the "weight" column of the order. This price per pound should be figured on the iron delivered to the molder and can be arrived at by figuring the cost of all iron, coke, limestone, cupola labor, etc., for a certain period and then taking the average cost.



Production for Thursday, January 7th 1904

No.	Names	Articles	Marks	Order Number	Number Up	Number Dlect.	Number Good	Weight Each	Weight Up	Weight Dlect.	Weight Good	Price Each	Amount per Man	Ck.	Amount per Order
1	F. Brandt	Brake Box	C.P.	387	4	4	4	220	10 510	11 220	10 510	11	2 75	✓	2 75
2	Simpson	Gear Case	P.16	386	20	20	19	140	2 660	2 800	2 660	12	2 40	✓	2 40
3	Wilson	"	P.16	"	34	1	33	70	2 380	70	2 310	12	2 40	✓	2 40
4	Robinson (Helper)	"											1 50	✓	1 50
5	Bradley "	"	P.16	"	38	2	36	70	2 660	140	2 520	12	2 52	✓	2 52
6	Walker	Gearing	W.H. 14	397	21		21	50	1 050		1 050		2 100		
7	Jones	"	" 14	"	19		19	50	950		950		2 00		
8	Anderson	"	" 14	"	11		11	975	10 725		10 725		2 25		
9	Hall	Weights	" 14	"	3		3	415	1 245		1 245		2 00	✓	2 00
10	Miller	Brake Shoe	W. 14	390	10	1	9	120	1 080	120	1 080	20			
11	Conner	"	" 14	"	12		12	100	1 200		1 200	20	2 20	✓	4 20
12	Brennan	"	" 14	"									1 50	✓	
13	Hughes	Gear Body Frame	C.408	395	5		5	340	1 700		1 700		2 75	✓	4 25
14	Peters	"	C.408	"	6	1	5	370	2 220	370	1 850		2 75	✓	5 50
					182	6	176		19 925		19 065		30 22		30 22
					12		12		1 080		1 080				

FORM 1.



MONTH January 1904

DATE	386 WT.	386 LABOR.	388 WT.	388 LABOR.	389 WT.	389 LABOR.	390 WT.	390 LABOR.	393 WT.	393 LABOR.	394 WT.	394 LABOR.	395 WT.	395 LABOR.	396 WT.	396 LABOR.	397 WT.	397 LABOR.
Totals	1230	49 40	80 80	4 75	540 00	11 25	440 00	9 25	1400 00	37 75	10 80	3 60	22 50	3 75	110 00	21 80		
2	30	2 25	4 00	1 00	12 00	2 25	13 20	2 20	24 40	3 25	10 80	3 50	22 50	2 75	4 70	2 25		
3	40	4 50																
4	36	4 50	12 00	1 50	12 00	2 25	33 00	2 80	22 80	3 01	10 80	2 75	19 00	2 75	19 90	2 37	27 05	4 25
			40 00	4 75	12 00	2 25	27 20	3 00		44 15					129 70	26 80		
5	40	4 50			9 60	2 25	27 20	3 00			10 80	2 75	11 00	2 75			26 10	4 00
6	36	4 50			9 60	2 25	13 20	2 20			10 80	2 75	22 50	3 75			26 10	4 25
											54 00	15 37	55 20	3 75				
7	20	2 50			7 60	2 25	22 80	4 20					38 00	3 50			49 05	8 25
	1230	49 40																

FORM 2.

In the illustrations it is figured at 1 cent per pound for the sake of convenience. The cost of molders' and helpers' labor on the order is entered in the same way in the "labor" column of that order. As the various amounts of material and labor costs are entered, they are indicated by a check mark in the "Ck" column of the production sheet, in very much the same way as would be done in posting to a ledger from a journal.

Each order should occupy but one space on the production sheet, or in other words the

Office Copy.
THE M. FOUNDRY CO.,
Pa. Dec. 10, 1903

Sold to A. B. Wilson Co. Order No. 396
Address Chicago Their No. Q 429
Ship to A. B. Co. F. O. B. Works
At Chicago Terms 30 days acc.
Shipment to begin Dec 24 1903 Shipment to be complete June 15, 1904

Marks	Articles	Number	Pat. No.	Wt. Ea.	Est. Wt.	Act. Wt.	Price	Total
A.B.W.	Plain Plates	690	R 16	80	552.00	552.00	.018	993 60

Cost			
Iron	552 80		
Misc.	16 46		
Cost Matl.	569 26	569 26	
Moulding	21 42		
Foundry	6 00		
Cleaning	2 76		
Non Pro.	13 16		
Cost Labor	128 22	128 22	
Total Cost		697 48	
Per lb.		.027	

The Foundry

FORM 3.

men working on this order should have all their names placed together, so as to facilitate posting to the cost sheet. In a foundry doing a business of the size of the one for which this system was devised, there are seldom more than six orders being gotten out at once, so if the names are kept together on the sheet, it takes but a short time to make up the cost sheet each day.

As each new order comes in, its number is

Foreman's Report for Jan. 7 1904

No.	Name	Article	Marks	No. Up	Rate	
8	J. Reard	Grate Bar	B 9	9		
14	Myers	Floor Plate	R 16	20		
13	Wendt	"	"	34		
6	Johnson	Helper				
16	Malley	Floor Plate		38		
29	Wilson	Helper				
18	Jones	Screen Plate	9R 14	21		
17	Hanson	" "	" 14	19		
22	Ray	Weights	" 18	4		
26	Wiles	"	" 18	3		
15	Conner	Grate Bar	H 19	10		
	"	"	" 18	12		
11	German	Helper				
23	Hayes	Boke Oven Frames	F 408	5		
4	Reuter	"	"	6		

The Foundry

FORM 4.

entered at the top of the first unused column that appears to the right of the cost sheet, and when work on it begins in the foundry the time and material costs are entered from the start. In the case of castings made for shop use, requisitions are made out, and they are treated in the same way as a customer's order. There are very few castings of this class needed at the shop where this system is in operation, so a case of this kind seldom occurs.

After the posting from the production

sheet is completed, the figures are proved by adding up the labor and weights for the day as they appear on the cost sheet and comparing them with the original.

When an order is received, it is entered on an order blank like Form 3. This is the ordinary order form, being made out in copies for the office, customer's acknowledgment, foundry foremen, shipper, and any other departments necessary. It can be conveniently arranged to work with a book typewriter, in which case the work of entering an order can be done more easily and speedily. The office copy which is shown here is made longer than the other forms, and provides a space for entering the cost. The acknowledgment and department orders are made to extend to the edge of the "total" column, and short carbon can be used so the prices will not appear on the latter.

As soon as an order is completed, its column on the cost sheet is footed up and the amounts transferred to the cost division of the order. Order No. 386 is shown here. It was received on Dec. 10, 1903, from J. V. Wise & Co., to be shipped to the G. C. Co., and is entered in the usual way. Each day the material and time on it are posted to the cost sheet, and on Jan. 7 it was completed The "386" column is footed up and the amounts of material and labor posted to their respective places on the order. As each order is completed, the same thing is done, new order numbers taking the places of the completed ones until the cost sheet is filled up.

The cost of other material than iron is gotten from the foundry report and added to the cost of iron, giving a cost of material of $529.26. The cost of cleaning the castings is gotten by counting the average cost per pound for a certain period. In a foundry where this department is on piece work the exact cost could be figured, but this method gives the cost very closely. The non-productive labor is then added, making the entire cost of labor as $128.22, and the total cost of the order as $657.48. The cost per pound is .0127. If a system of daily cost is run, this affords an opportunity for comparison by getting the order costs for a certain period, say a month, and then comparing them with the daily cost for the same length of time. It depends largely on the business as to whether both methods are necessary, and in the present instance it is not done.

The order having now been finished and the cost computed, it is filed in a binder marked "Completed Orders" and remains as a permanent record It is thus an easy matter to refer to any order, with its cost without trouble, both being on the same sheet.

This system can be applied to any foundry doing a moderate sized business, and is convenient and practical in every respect.

LIMESTONE IN THE CUPOLA.

BY N. W. SHED.

There are all sorts of opinions about limestone. One foundryman says he is afraid of it, but will be persuaded to use a bushel of oyster shells now and then to clean out the furnace. Another foundryman says, "Yes, it is a good thing, but I don't use over 10 pounds to a ton of iron for fear it might cut the lining or weaken the iron." The third foundryman, the progressive one, says, "I want to use limestone, but I don't know what is the best proportion." It is hoped that this article may bring out the best proportion to use, also that it may invite foundrymen to give their experience with limestone.

The action of limestone is much like the action of soap. It removes dirt and by dirt we mean the sandy or earthy matter in the coke ash, in the pig, and upon the scrap. The cokes usually carry 10 percent of earthy matter, most of which must be slagged off by adding limestone, though occasionally some cokes will be found carrying some lime, and in these cases the ash will be found more or less self-fluxing. Pig iron usually carries 5 to 10 percent of sand and scrap will often carry 2 to 10 percent As there is apt to be considerable variation in the amount of earthy matter it is well to have enough lime to slag it off, though a large excess of lime will do no good.

When we add lime to the cupola charges we wish to add enough to unite with the earthy matter and form a slag which will run readily at the ordinary heat of the cupola, making what is called a thin slag, containing but little iron. We can get such a slag as this by adding lime to the amount of 15 percent of the weight of the coke or in common melting about 40 pounds of limestone to each ton of iron. It is better practice, however, to figure the amount of limestone upon the amount of coke and add the limestone with the coke. The limestone should be crushed to inch size

and if well scattered over the coke will absorb a certain amount of sulphur from the coke as the coke burns. For instance, if the coke bed is 2,600 pounds, put over it 15 percent or 390 pounds of limestone, 400 pounds in round numbers, then follow with pig and scrap. The next charge is 600 pounds of coke, put over it 90 or 100 pounds of limestone and follow with pig and scrap, being careful to spread the limestone over the coke in each case, and thus with each succeeding charge. If you should diminish the amount of coke, then the limestone would be diminished in the same proportion.

This amount of limestone is not excessive. If the cupola is running large heats and tends to work sharp and hot, 20 percent of the weight of the coke is not too much. In fact, the large Bessemer cupolas often use this amount right along. Above 20 percent it would be best to proceed with caution, for the large amount of lime would produce a stiff slag, hard to melt, and with the low heats of some furnaces the lime would not take up the sand but would form lumps in a sticky cinder. The danger of a lime cinder cutting the brick lining is overestimated by cupola men. In our case we found that the cupola lining was cut no more by using 15 percent limestone than it was by using 5 percent, and in cases where no limestone was used, the oxide of iron cinder cut the lining much faster than any lime cinder. The cost of the limestone is more than saved by less waste of iron. A cinder without using lime will run from 17 to 23 percent in iron. By using lime the cinder should not run over 6 percent in iron. Our last cinder was 4.8 percent iron. A neighbor of ours running hotter iron had a black cinder with 11 percent of iron, using the same amount of limestone.

A good cinder will protect iron from oxidation by the blast and though the action of the coke prevents much oxidation, there must be a certain amount of oxide of iron taken up in the casting, which is productive of more mischief than we dream of. In selecting a limestone for the cupola, see that the percentage of silica is low. If possible, not over 2 percent. A great deal of limestone now delivered to cupolas runs from 5 to 10 per cent in silica. This means a large amount of the stone must be spent in fluxing its own dirt. This makes a larger bulk of slag to handle and also consumes more coke. It would pay to have every lot of limestone tested for silica and occasionally have the amount of ash in the coke estimated.

The slag obtained by using the above percent of limestone does not have the black color of slag containing much iron, but is brown in color and is nearly transparent on the edges, like brown bottle glass. It is very brittle when cold and allows the cupola to be chipped with ease. As it flows on the ground it can be drawn into strings as it cools and sometimes the blast will blow it into slag wool.

To sum up the advantages of limestone, we find:

First—It absorbs sulphur from the coke.

Second—It prevents a waste of iron.

Third—It makes a good cover for the molten iron, preventing oxidation.

Fourth—It insures a clean cupola.

Let us hear from others in regard to this.

CUPOLA PRACTICE.*

BY DAVID SPENCE.

There are few trades that require as much thought and care as that of the foundryman. There are many things that the up-to-date foundryman must keep on his mind if he wishes to be successful. The management of the cupola is one of the most important of these details and the well managed cupola is one of the stepping stones to success. After the cupola has been properly lined, the foreman should see that his cupola man keeps the cupola well daubed up and in proper shape. The question may be asked, "What is the best lining for the cupola?" Where it can be obtained, good fire clay undoubtedly forms the best lining. This should be mixed in the proportions of one part of clay to two parts of fire sand.

After your cupola is nicely lined, put up the bottom and then put in a bed of sand about three or four inches deep. Make this sand bed as damp as ordinary molding sand. If the sand is too damp it may cut and allow the melted iron to reach the door, which will result in a run-out. If the sand is too dry, the same thing may occur.

Some one may ask, "How should I put in my bottom?" Your bed should be made a little higher on the back, or it should be formed somewhat like a saucer. When the bed has been made firm and solid, put in shavings and kindling wood enough to light the

*Paper read before the Chicago Foundry Foremen's Association.

coke, then put your coke on, light the fire and allow it to burn up to a good cherry red. The amount of coke will depend on the diameter of the cupola. From 850 to 1200 pounds is used in an ordinary cupola.

To those not acquainted with cupola practice, I would say have at least 15 to 18 inches of coke above the tuyeres. When the coke has burned up to a nice red heat, add enough more to make your bed level and commence charging the iron. The first charge should be 30 to 40 hundred pounds, according to the size of the cupola, and succeeding charges should be smaller, as your iron will melt faster and hotter.

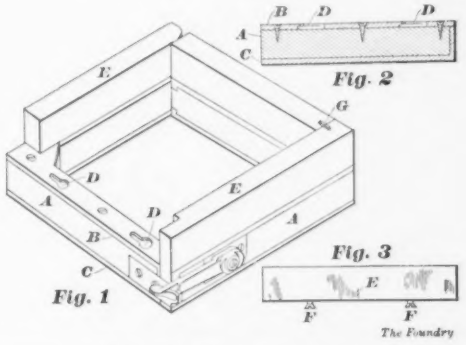
I had charge of a foundry melting four tons per day and when I went there the iron was dull and sluggish. I instructed the melter to cut his charges in two and he did so. The result was that his iron was hot enough for car and locomotive work.

The question is often asked, "At what rate should you melt?" That depends on the class of work and the amount of iron melted. In light work a ratio of 1 to 6 and in heavy work a ratio of 1 to 8 is about right. But right here I should say, do not try to save one hundred pounds of coke and lose a ton of casting in doing so. I have heard about those big feats in melting and have always found more scrap than castings. In my own experience, I find it cheaper to buy scrap than to make it.

I have been asked, "How many ounces of blast pressure do you advise?" Where you use all coke, ten ounces is sufficient. With part coke and part hard coal, twelve ounces should be used. Care should be taken to see that the charges are made even. The smaller you break your pig iron the faster the iron will melt, as the iron commences to melt at the ends of the pigs first.

SNAP FLASK EXTENSIONS.

To overcome the difficulties of the ordinary method of extending the depth of snap flasks by screwing on strips of wood, a neat device has been invented and patented by William Lotz Jr., Christian Wismeyer, Charles S. Hammer, Frederick Thoma and Henry A. Renschler, of Hamilton, O., and has received a thorough trial at the plant of the Hamilton Foundry & Machine Co. The invention pertains to a construction of flasks permitting ready variations in their depths. Fig. 1 is a perspective view of a half flask of the snap type, one of the extension walls being omitted. Fig. 2 is a vertical longitudinal section of one of the walls of the half flask proper and Fig. 3 is a side elevation of one of the extensions. The four walls of the half flask, which may be in the present instance either drag or cope, are indicated by A and have metallic facing strips B on the upper edges. Similar facing strips C are on the lower edges (or joint) at the faces where the cope and drag will meet when the two are put together. Openings of keyhole shape are made in the facing strips B at D, the slotted portions of the holes pointing in the same direction and parallel with the length of the flask wall in which they are located. Extension strips E, one for each of the side walls A, increase the depth of the flask which has the usual latch and hinge and there are buttons F projecting from the lower surface of the extensions to engage the openings D, the buttons being represented as formed by the projecting ends of common wood screws. The openings D have their



slotted portions wider below than above, the margin of the slots thickening in a direction away from the eye of the opening. The result is that the extension E may be placed downward upon a supporting wall A with the buttons freely entering the openings D and then an endwise movement of about half an inch will cause the heads of the buttons F to enter under the edge of the slots and the taper will wedge the parts in close contact. The distance the two parts slide to become locked in place is a matter of choice but the amount given is in use with satisfaction. It has been found in practice that if the parts are so fitted that the extensions while fitting with fair snugness can be easily applied by hand and without endwise driving then the damp sand very shortly brings about such a firm locking of the parts that pretty heavy driving is required in removing the extensions.

Extensions of various depths may be kept on hand so that shallow flasks may be con-

structed and thus reduce the cost of snap flask equipment. It will be seen that the extension strips E overlap at the ends in successive order and are therefore applied serially, the second positioning the first as they are put in proper location. When the extension strips are of considerable depth they may be tied at the corners, as illustrated at G, by means of staples. The joint strips C between the two half flasks are gauged by the usual dowels and dowel holes. The flask formerly used was sent to the carpenter shop when a raising strip was required and this meant a loss of time to the molder in most cases, a delay of some consequence where 350 snap flasks are in service as at the Hamilton plant. These have been equipped with the strips and where the carpenter took from fifteen to twenty minutes to put on the extensions, the molder puts them in place in three minutes and does not mar the surface of the flask with screws. When the snap flask is closed the strips are interlocked and it is impossible to take them off.

Patents.

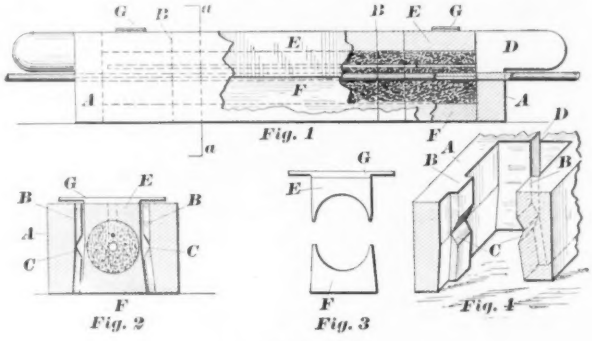
A machine for packing the sand around the pattern in making a mold for casting car wheels has been patented (No. 752,780) by Joseph G. Johnston of Detroit, Mich. The invention comprises a turntable on which the patterns are placed with skeleton flasks and a hydraulic or other press to compress the sand.

William C. Norcross, of Terre Haute, Ind., has patented (No. 752,797) an improved cope for car wheel manufacture. The cope consists of a shell with chill ring and having wedge shaped arms with vertical vent passages. The main object of the scheme is to secure better ventilation of the cope and the invention is especially designed for use with the molding equipment of the American Car & Foundry Co.

A New Core Box.

A core box has been invented by Samuel E. Barnes, of Holyoke, Mass., and it consists of a two-part core box, supported in a frame which also holds a vent rod. Fig. 1 is a side view of the device in elevation, partial fracture and vertical section. Fig. 2 is a section through the line a-a in Fig. 1, and Fig. 3 is an end elevation of the parts of the core box. Fig. 4 shows a portion of the frame in perspective. The rectangular frame A has handles at the ends and on the under side are guide spots B. The frame is grooved at C and has its ends slotted at D. E and F are the upper and lower halves of a core box and it will be seen that the sides of the lower portion F and the lower sides of the frame A flare downwardly.

In operation the lower half F is laid on the bench and the frame A placed over it. The guide spots B center the box in the frame and leave a clear space on each side. A supply of sand is scattered in the frame, a vent rod dropped into the slots D and the frame filled with sand. The upper part of the box is now forced down into the frame and is guided by the spots B to position over F. The box is rapped and the vent rod withdrawn. The frame A and the part E are now lifted, leaving the core in the lower half of the box. The upper half of the box may be equipped with transverse bars G extending over the top of the frame so that parts A and E can be lifted together.

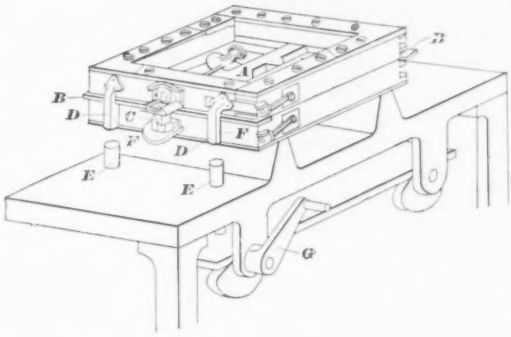


A NEW CORE BOX.

Improving the Foundry Equipment.

Two recent patents have been obtained by Henry G. Voight, of New Britain, Conn., on a molder's flask and gated pattern and on a molding machine. A perspective view of a flask constructed in accordance with the improvements suggested is exhibited and has a gated pattern located between the closed sections. The cross bar A constitutes the gate and has at each end the bearing plate B resting on the lower sections of the flask. A series of lifting pins are combined with the flask so as to separate the flask halves from each other as well as the pattern from such sections. A V-shaped guide pin C is fastened to the drag and a guide and bracket to fit each

of the pins is secured to the cope half of the flask. Projecting downward from the cope section is a pair of posts D, which meet lifting pins E, supported on a carrier on the machine frame. These projections extend outward beyond the edges of the bearing plates B and then turn downward. The lifting pins E are designed to draw the pattern, though they do not become operative until the cope has been



raised to the desired distance. This delayed drawing of the pattern is accomplished by the contact of the lifting pins E as they move upward carrying the cope, with the ends of projections F on the bearing plates of the pattern. On turning the handle G the carrier supporting the lifting pins E is raised through the operation of cams. The continued movement of the mechanism lifts the cope and then draws the pattern. Both may now be removed and the mold stopped off to prevent the metal flowing out through the passages made by the gate

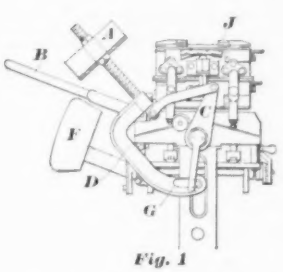


Fig. 1

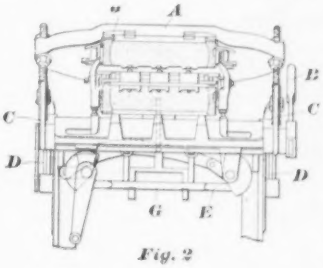


Fig. 2

and the bearing plates. The cope can now be replaced upon the lifting pins and the handle G given a reverse motion to permit the cope to descend and rest upon the nowel.

A more elaborate application of the scheme is described in the patent covering a molding machine. Fig. 1 shows an end view of a molding machine with the flask in position on the table and ready for ramming, the presser bar being represented as thrown back from the flask. Fig. 2 illustrates the machine when the pattern has been lifted free from the nowel. The mechanism comprises a presser bar A, which may be brought from a position behind the flask to a position over the flask, where it is operated by a lever B. On opposite sides of the presser bar shaft are arms C connected with links to the curved levers D, and these are coupled by a cross bar E passing through a guide slot. A counterbalance F holds the cross bar E in an elevated position in the slots. The counterbalance lever has branch arms which are caught under the crank G of the bar E. When the lever B is brought forward, towards the right in Fig. 1, the presser bar will be swung above the flask on the platen, the counterbalance maintaining the presser bar sufficiently high to clear the flask. The edges of the arms D come in contact with stops preventing further forward movement of the presser bar, and continued rotary movement of the shaft draws the bar down, depresses the arms D and the cross bar E and elevates the weight F. The parts are so connected about the center lines of the arms C as to constitute a toggle and produce a powerful pressure at the appropriate time. It is asserted that results obtained in practice show that a comparatively slight experience is sufficient to indicate the amount of sand for a mold of the required density.

The Casting of Metal.

A patent granted to the firm of Williams & Robinson, Ltd., of Victoria Works, Rugby, Eng., and to J. Eaton-Shore pertains to the casting of metals in thin metallic molds. Before the metal has had time to cool these are lowered gradually into water or are otherwise cooled gradually from the bottom up, the object being to insure the cooling of the metal before the particles of any of its constituents have time to segregate. The prevention of such collections in the casting results in the production of a more nearly homogeneous product. The inventors point out that the thickness of the mold walls must be varied to suit the nature of the casting; a thin walled mold is necessary for a thin walled cylinder, etc. In the case of alloys which fuse at a comparatively low temperature, the molds may be as thin as the practical requirements of strength will permit, sheet steel being suitable in the

case of the majority of castings made from the "anti-friction" metals. Any of the following methods may be adopted to this end: The mold may be sunk in water to a desired depth and the metal poured while in that position; the mold may be held over the tank containing the water and lowered into it at the same rate as the metal rises in the mold, the surface of the molten metal in the mold being maintained a trifle lower than the level of the cooling agent outside; the mold may be first filled with metal and then lowered into the water.

The mold for casting a phosphor-bronze cylinder is seen in section in Fig. 1. The flask A is made of cast iron with two eyebolts B for convenient handling. The flask interior is slightly taper, of smaller diameter at the bottom than the top, to give close contact with the outside of the casting and the inner wall of the mold as the cylinder contracts in cooling

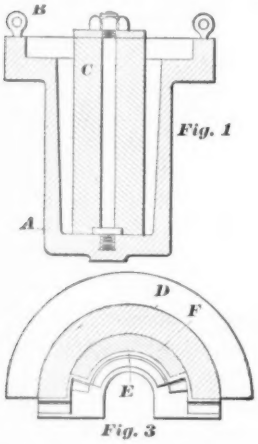


Fig. 1

Fig. 3

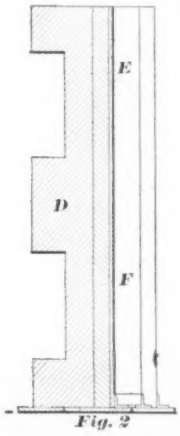


Fig. 2

and descends in the mold. The close contact assists in the cooling effect when the operation of pouring is finished. The core is seen at C and in place of a solid core it is suggested that a hollow core may be employed, thin sheet steel giving much better results in the case of white metal.

The method of lining a cast iron bearing with white metal is illustrated in Figs. 2 and 3, the bearing being shown at D, and E is the core of thin sheet steel. A spray of water is directed upon the inside of the core E as the metal F is poured. The jet of water is played first at the bottom of the core and raised with the head of metal. The inventors find in practice that the core, owing to its thinness, does not unduly chill the alloy, and as the cooling takes place there is a good head of fluid material to draw upon for a sound casting.

A PROBLEM IN MOLDING SAND.

During the past few years a number of foundries whose floor space has been limited have put in sand conveyors. The molds, when poured, are shaken out over a grating, the castings remaining on the grating, while the molding sand falls through and is carried by the conveyor to some point on the floor below, where it is freed from metal shot, etc., by sifting, wet down, tempered and carried back to the molding floor. When the sand is returned to the molding floor it is usually delivered overhead to points where it will be required. This overhead delivery is accomplished by a reciprocating conveyor.

When there is only a short drive this system seems to be fairly satisfactory, but with a long drive the shaking or vibratory motion of the conveyor seems to produce a mechanical separation of the sand, causing it to agglomerate into small pellets that have no affinity for each other and that act, even when moist, like so much quick silver. The sand when in this state seems to have lost its "body" and although apparently well tempered, it cannot be rammed hard enough to produce a good mold that will not cut when the metal strikes it. Crushing the sand by means of a pair of rolls seems to improve it, but not to bring its quality up equal to that of sand which has been cut and tempered by hand and not passed through a conveyor.

While this article is written rather for the purpose of inviting discussion of the question than to attempt to offer a solution of it, the following explanation is offered by the writer. Molding sand consists of particles of silica, each one of which has its own individual coating of clay, more or less plastic. On the amount of this jacket of clay and on its plasticity depends the "body" of the sand. The grains of silica have received their clay jackets by a process of sedimentation in clayey water when the sand banks were being formed.

Now if the clay is separated from the grains of silica by the motion of the conveyor and this separated and finely divided clay were agglomerated into little pellets having the outer surfaces covered with the denuded grains of silica, along with particles of oxides and very fine metal shot, we would have just such a sand as we find the conveyor sand to be. The improvement effected by the rolls would then be assigned to the fact that the clay in the center of each pillet was set free so that it

could serve as a bond again to hold the grains of silica together.

A centrifugal mixer in connection with a set of rolls is said to have been used by one party without much success. Another plan proposed is to deliver a large amount of sand into a capacious box and then draw off from the bottom a considerable amount of sand. The weight of the superimposed sand is said to restore the sand at the bottom of the box to its original condition. This scheme does not seem to have much to recommend it. Discussion of this problem should prove very interesting.

J. L. J.

A REMOVABLE FLASK PIN.

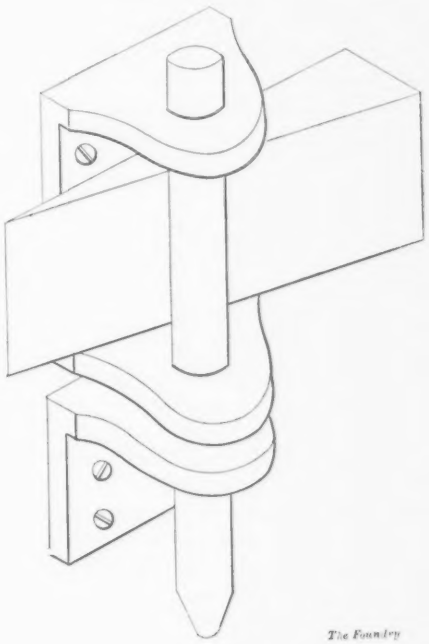
BY CHAS. W. CLARK.

Some time ago I was requested to contribute something to *The Foundry*, but until now have never thought of anything of interest to send. The accompanying drawing shows a removable flask pin which I have gotten up and find that it is such a good thing that I wish to pass it along to readers of *The Foundry*. I call it the "Knockumall" pin.

I have noticed from time to time articles on different styles of flask pins, both fixed and removable. Some of them were commendable, but most of them have too much machine work and fitting to do. The great trouble with fixed and permanent pins is the great liability to breakage, or even worse, the loosening of the plates while shaking out. When the plates are loosened, the poor molder must tighten them up the best way he can and then get a blessing from the "old man" if his casting comes out showing a shift. If the pin was broken the flask would go to the carpenter shop.

I believe in being liberal with our own ideas. If you have anything good, pass it along. There are men who, when they have a good thing, simply because they cannot afford to patent it, keep it to themselves, and there it dies. Then there are others who tell their ideas, and the trade at large gets benefited thereby. Still others try to keep all ideas to themselves or in their own shop, and when some one else gets something up and passes it along they get up and make a howl that they have used the same thing for twenty years and never got any credit for it.

The particular advantage of the Knockumall is readily seen at a glance. The ease with which the pin is fastened and removed is certainly a great advantage. The pin should not be removed until after the flask has been properly clamped, thereby avoiding a shift. Another advantage of the Knockumall is that it can be adjusted to any desired length. When there is a deep lift or a long core up in the cope, the advantage of a long pin is apparent. The greatest advantage it has over any other pin is the simple way of fastening. All that is necessary is to procure a wooden wedge, with which the average shop



is plentifully supplied, and drive it lightly between the pin and the plate. To loosen the pin strike a little tap on the thin end of the wedge. The plates are cored out to 9-16 and then a 5/8 drill run through to bring it to the exact size.

The face of the plate between the lugs on the cope part must be flat to allow a good bearing for the wedge.

The Pittsburg Valve & Fittings Co. will build a malleable iron foundry as an addition to their works at Barberton, O.

Work on the new foundry of the Burns Boiler & Mfg. Co., of De Pere, Wis., will be resumed as soon as spring opens. The foundation was put in last fall. The foundry will be 57 by 150 feet.

Ruka Bros., of Boscobel, Wis., will erect a foundry 30 by 50 feet.

REVIEWS.

Gases in Pig Iron.

Stahl und Eisen, Jan. 1st. An interesting article on the above subject by E. Muenker, of Geisweid, illustrates among other things the method of catching the gases escaping from molten pig iron, and also when boring pig iron in its solid form. The gases being lead into suitable apparatus for analysis. In the first case the iron is poured into an ingot mold with bottom pour, and as close to the furnace as possible. A plate is bolted to the top of the mold and the first gases allowed to escape through a pipe let into it. After all the air has been expelled, the gases still coming from the molten iron are caught tor analysis. In the case of boring pig iron, this is done under water, an inverted funnel shaped collar allowing the drill to rotate through it and the gases passing upward are caught in the funnel and passed out and are caught.

Not only have we to deal with the chemical composition of pig irons, but also their power for holding absorbed gases. The overheating of the iron in the hearth, its pressure, the moisture in the blast, and a number of other things have their effect. Thus the moisture in the blast influences the hydrogen content of the gases, the amount of these being a function of the fluidity of the metal to a great extent. A very liquid iron gives off its gases freely before setting, while the foundry irons, which are rather viscid, entrain very much greater quantities. The average of 13 analyses of gases in foundry pig irons of 2 to 3.5 percent silicon, with but a trace of sulphur, and 0.4 phosphorus, gave 0.5 percent oxygen, 6.4 percent hydrogen, 4.5 percent carbonic oxide, and 8.6 percent carbonic acid.

The gases taken from the solid pig iron of the same composition, showed a marked change, being but one-half hydrogen with almost none of the other gases enumerated. The object of making these tests, so far as foundry irons are concerned was to if possible discover the reason why the metal made in comparatively small blast furnaces, and with the cooler ranges of blast, were so much better for foundry purposes than metals made in the largest furnaces run with very hot blast. While these results do not prove anything definite, they give rise to the speculation whether the absorbed gases are not to some extent responsible.

Gas Analysis an Aid in the Cupola Process.

Eisen-Zeitung, Jan. 21, has an article by Dr. C. Waldeck, in which he calls attention to the value of analyzing the gases coming from the cupola in order to regulate the process to the best advantage.

The cupola process does not rest upon the chemical reaction of the coke on the metal, as in the blast furnace, but rather upon the simple heating conditions obtained by burning the fuel. Hence the gases should be studied from that standpoint only. As coke in burning to carbonic oxide evolves but one-third the heat it does when burning the carbonic acid, necessarily any undue amount of the former compound detected in the escaping gases means a waste of fuel. The ideal condition is to obtain comparatively cool products of combustion tolerably free from carbonic oxide. For this purpose it is necessary to find the best mean in the weight of the charges, and the most economical low pressure blast. Too heavy charges mean the formation of much carbonic oxide, while making them too light allows too much heat to escape without giving it off to the stock properly.

A series of tests were made with a cupola in which the upper row of tuyeres had been stopped up, and hence could not furnish the air necessary to burn the gases properly. The result showed that the escaping gases contained twice as much carbonic oxide as carbonic acid, in other words, a clear waste of fuel. The article concludes with the remark that this shows the value of analyzing the waste gases from the cupola. To our mind it would show something further, and that is the urgent necessity of about 3,000 out of our forty-eight hundred foundries, getting a modern cupola, one which does not illuminate the whole neighborhood with its burning carbonic oxide gases. The upper row of tuyeres is something which these foundrymen should consider.

Portable Brass Furnaces.

The *Mechanical World*, Feb. 12, gives illustrations of a portable crucible furnace which is operated by compressed air. As many of our foundries are now equipped with a compressed air plant, this will interest us. Wherever there is any "burning on" to be done, as, for instance, the liners on a propeller shaft, a portable furnace will save much handling and inconvenience, as it enables the work to be done right in the machine shop. Moreover,

where a special metal is to be used for a hurry-up job, a furnace of this kind is indispensable. Three of the largest foundries on the Clyde are using them right along with perfect success.

The furnace consists of an iron frame with four wheels, on which is the ash pit, which is also the air box, the compressed air entering under the grates. On this air box is placed the furnace proper, which is divided into two parts, each caring for a crucible. Heavy iron bars hold the box, which is built out with fire brick, together, and a cover is placed over each furnace compartment. The No. 10 crucibles, holding 20 pounds each, last 65 heats. The construction of such a furnace is a very simple matter, practically requiring only coke space around a crucible, removable rods for grate bars, and the air box tight, so that the compressed air brought in by attaching a hose at any point of the shop, will go up through the bars and burn the coke. Those who are familiar with the European coke stoves for drying molds by blowing air through incandescent coke contained in them, and directing the flow of heated air into the damp molds, will see that the above furnace is merely an enlargement of this device, to accommodate a crucible or two for quick melting of brass or bronze in sufficient quantities to be of practical use about a jobbing shop.

The Effect of Limestone on the Cupola Charges.

Stahl und Eisen, Jan. 1st. Dr. Wuerst discusses the results obtained by Mr. Sulzer-Grossmann, who tried the effect of varying quantities of limestone in melting iron in the cupola. As a rule the amount of limestone is regulated by the melter to suit himself, the proportions varying widely, say from 10 percent up to 35 percent of the fuel used. If it is remembered that the object of adding limestone is simply to slag off the ash from the coke used, other conditions remaining the same, it would seem a simple calculation to obtain the right amount. The purer the limestone, the more direct will be the action. Where we have to deal with large amounts of clay, etc., in it, much of the calcium oxide contained will have to expand itself in slagging these foreign substances before the ash of the fuel is attacked. In addition to the removal of the slag, the limestone also takes up sulphur, being a very great help to the foundryman indeed in this respect.

A series of tests were made with a cupola supplied with a fore-hearth, there being two rows of tuyeres. Eleven melts were made of the same charges with amounts of limestone beginning with 3.3 percent in the second test, the first having none, and ending with 33.3 percent in the last test. The slag was carefully collected, weighed and analyzed each time. The analyses of the resulting castings show that a varying amount of limestone has no effect on the results except in their sulphur. The more limestone, the lower the sulphur, a difference of .44 percent being observed in the element during the range.

The composition of the slags was quite complicated, and little could be judged beyond the fact that the thinner this was, the better it absorbed the sulphur. The melting loss increased with the amount of limestone used. The loss in silicon averaged 14.08 percent, which is normal. The melting loss varied between 0.8 and 1.6 percent as limits, which is a vary good showing, and would indicate that the figures recently published by the American Foundrymen's Association were not so abnormally good as was supposed by many foundrymen.

Foundry Improvement.

The *Mechanical World*, Feb. 12, 26. Expressions of opinion on foundry improvements are included in the column headed "Letters to the Editor." These expressions of opinion from an English standpoint are interesting, and a few are given herewith. "W. J. L.," for instance, holds that chilled castings on remelting revert back to the original quality of iron, giving this as his experience with plowshares which he uses as ordinary scrap. The war of opinion on this point has been settled as per the above several years ago here, and we are glad to see that England is now awaking to that fact also. The same correspondent does not find that aluminum additions toughen iron. "M" now comes in and holds that the addition of aluminum strengthens cast iron. He further discusses the derivation of the word "fake" which founders on the other side seem to use as a synonym for "physic," and thus unconsciously hits the mark, for physics are nearly all fakes. He goes on to prove that aluminum, if added to cast iron, can always be traced in the metal afterwards, citing a large number of examples. He seems to refer to the use of large quantities, as where the usual 0.1 percent addition is employed, there is seldom a trace left in the casting, the alum-

inum expending itself in combining with the gases, and going into the slag. "M" finally urges foundry owners to pay more attention to their cupola men, so that the best grade of work is performed there, the saying that "any fool can manage a cupola" being altogether too prevalent.

It would seem that England has need of foundrymen's associations to disseminate information among the members of the industry. We have gone through our period of adjustment to more scientific methods some years ago, and today one is not surprised to attend a meeting of foundry foremen, and find that they are perfectly capable of discussing the chemistry of iron, and to calculate mixtures based upon the chemical composition of the metal available.

Melting Loss in the Cupola.

Stahl und Eisen, Jan. 15. In connection with the experiments made by Mr. Sulzer-Grossmann, reviewed elsewhere, a further series of tests made in a jobbing foundry are given as bearing upon the melting loss in the cupola. The sprues melted by the foundry in question amounted to 30 to 40 percent of their charges, no bought scrap being used. The first series of tests, made in two cupolas, took these sprues as they came from the foundry. The second series, in the same two cupolas, were made with the sprues rolled clean. All weights were carefully recorded, and the following were the results:

255 tons of iron lost 1.54 tons, in 13.8 tons of slag, or 0.6 percent melting loss. This was with the sand adhering to the sprues and pig. With clean sprues and sand pig the results were:

184 tons of iron lost 0.64 tons, in 6 tons of slag, or 0.35 percent melting loss. Had the pig iron been free from sand, that is, machine cast, the slag made would have been still less, and the iron lost but 0.30 percent, which is an extremely low figure.

Foundry Coke.

Giesserei-Zeitung, Feb. 15. Count von Gienanth discusses this question from a number of standpoints. He calls attention to the fact that Americans have given much attention to the details of the melting process in the cupola, in order that protection may be had from the vagaries of this process. When, however, everything is considered, the coke is after all the most important element in the chain of circumstances which regulate the quality of the iron tapped from a given charge. First of all comes the chemical composition of the coke, which should be made the subject of specification. The German Foundrymen's Association appointed a commission to study this question, but was so poorly backed up by the founders themselves, that so far nothing has come of it. We have the same trouble over here. The makers of coke over there will not guarantee their analyses, but in most cases where they have connection financially with furnaces and steel works, they are held down to specific points, and seem to be quite able to come up to the requirements. Why not then for the foundry also? Perhaps it needs a little more education on the part of the foundrymen to know the value of specifications in buying, and standing together to enforce these specifications. A record kept by a prominent foundry in Berlin gives the composition of the coke furnished it by the several coke agents. The object was to see how much was being paid for water, as well as to get the analyses. Fifty analyses are given and we note that the moisture in the coke, paid for as coke, ran from about 1 percent up to over 9 percent, the average of the 50 cars being 3.44 percent, this where the coke had been shipped in box cars. Where the coke came exposed to the weather, we note an extreme case of 21.05 percent water. The ash in the coke ran from 6.67 to 11.03 percent, which is not bad, and the sulphur from 0.85 to 1.54, which is high, but not nearly as bad as some coke which was palmed off on founders during our recent period of prosperity.

While it is held that coke should be analyzed for water for purposes of payment, yet the author of the article under consideration advises that coke be wet before being charged into the cupola, holding that the moisture which must be driven out before the coke can burn will enable this to reach the melting zone before being partially consumed by the hot gases passing through it were it dry. Presumably this does not refer to the bed. In addition to determining the ash, sulphur, and moisture of the coke, its strength should be tested. Methods for doing this are necessarily expensive, and the author suggests that a large cylinder be filled with the coke to be tested, and a piston be pressed down upon the contents for a given distance, the power required being noted. Finally we are advised to make our specifications call for sulphur not over 1.3 percent, ash not over 9 percent, and moisture not over 3 percent.

Alloys of High Tensile Strength.

Machinery, February, '04. In answer to an inquiry from a subscriber concerning the characteristics of Dr. R. H. Thurston's well known metal containing 55 parts copper, 42.05 parts zinc and .05 tin, Herbert E. Field contributes an article of considerable interest.

He states that Prof. Thurston's experiments were tried in the laboratory, using small amounts of metal and casting test bars in metal molds. By this means temperatures could be closely controlled and the casting of the bars in metal molds increased the tensile strength. In commercial practice it is impossible to obtain any such strength as Prof. Thurston gave, which was 68,000 pounds per square inch. He calls attention to the fact that it was difficult to produce an alloy which will analyze in just this proportion on account of the fact that the large percentage of zinc causes rapid oxidation. This is especially true if scrap metal from the preceding heats is used.

He states that he has used mixtures with 1 per cent of tin and still obtained good results but that this decreased elongation.

The chief difficulty with these mixtures lies in their tendency to form an open crystallization metal which is not homogeneous.

There are four factors which enter in to make a successful bronze of this composition. First, composition; second, purity; third, temperature to which it is heated; and fourth, method of mixing.

Composition.—Composition must be kept within fairly uniform limits, though an increase of ½ of 1 per cent in the tin does not affect the strength, but does reduce the elongation.

Purity.—It is absolutely necessary that the metal used should be pure. Ordinary commercial metals contain too large a percentage of impurities. Most cheap commercial zinc contains a large percentage of lead. A very small percentage of lead will greatly reduce the strength of this bronze. In fact it is absolutely necesary that the lead be kept down to a trace, if good and uniform results are desired. It will be found economy to pay the extra cost for the higher grade of zinc. There is considerable variation in the copper but it is not certain what element is detrimental. He has noted the fact that the copper having a high electrical conductivity will give good results and hence it is well to have copper tested in this way. Such a small percentage of tin is used that it is not likely to contain a sufficient amount of impurity to damage the alloy. It should, however, be free from lead.

Temperature of Heating.—The duller this metal is cast and still at a high enough temperature to give a casting free from blow holes the stronger the metal will be. The decrease in strength due to high heating may come from three causes. 1st, crystallization; 2d, segregation; 3d, oxidation. The slower the metal cools, the larger will be the crystallization and the more pronounced the segregation. The hotter a metal is poured, the longer it will be in cooling, and hence the greater will be the segregation. He calls attention to the fact that the fracture frequently shows different structure in different parts and that analysis has shown the tin to be quite badly segregated.

It is well to add a small percentage of aluminum to the mixture, as it seems to increase the strength; it is supposed that aluminum acts as a deoxidizing agent. A very small piece of metallic phosphorus added to the metal improves it, provided none of the phosphorus is left in the bronze. As it is a difficult matter to get just the right amount of phosphorus and as an excess of aluminum does no damage, the latter metal is to be preferred.

Method of Mixing.—The one point to be kept in mind in molding and mixing this alloy is not to overheat it. There are two methods which can be used. If all new metal is to be employed, the copper should be melted first, allowed to cool down as far as possible, and then the zinc and tin added. The mixture should be well stirred with a carbon stick and when the correct temperature for pouring is reached, the aluminum should be added and stirred in. If scrap metal from previous heats is to be used, the copper can be melted and the scrap used to cool it to the proper temperature for adding the zinc and tin, or the scrap can be melted and used as a bath to melt down the copper.

The latter method saves a little time in the melting, but exposes the zinc in the scrap to considerable oxidation and results in loss, hence the former method is to be preferred.

In conclusion he says that it is not possible commercially to obtain a metal having a strength of 68,000 pounds per square inch; 50,000 pounds is as high as can be expected from regular casting and in order to obtain this every precaution must be taken. The most important precautions are, first, to use pure metal; 2d, not to overheat; 3d, to add aluminum if necessary.

Pig Iron for Malleable Castings.

Stahl und Eisen. March 1st. Dr. F. Wuest, editor of the foundry department of this German journal, goes into the pig iron available and imported into that country for the purposes of the malleable shop. The composition of the pig iron used naturally depends upon that wanted in the castings. Manganese must not be too high, as also phosphorus. The former makes trouble in the anneal, and the latter in the annealed castings when in use. German malleable castings do not run over 0.120 percent in phosphorus, and more generally between 0.08 and 0.10. In America double these amounts is more generally the rule.

On the other hand the sulphur is not at all low, for while we average here some 0.05 percent of this injurious element, they run between 0.07 and 0.12 for the crucible work, with exceptional cases of 0.20, the difficulty lying in the lack of low sulphur irons for this class of work. For the cupola the conditions are even worse, no malleable iron castings being made by this process with less than 0.14 sulphur, the range being about from 0.18 to 0.25, with an occasional 0.30. When we see these figures we might just as well understand that the material made in Europe is nothing like the American product, for our fracture is black, and their's white.

The silicon in the German castings runs between 0.4 and 0.6, with the extreme limits from 0.23 to 1.03, which fits our practice. As to the carbon, Dr. Wuest states that this ranges from 0.7 to 2.34 percent in the annealed castings. When the material is annealed at least 100 hours at temperatures ranging from 1825 to 1900 degrees F, the total carbon is regularly below 1 percent, the silicon being presumably high. When this is low, and the ovens are kept below 1825 degrees F, more than 1 percent carbon remains in the castings, and they must be reannealed. This peculiar condition also gives us an insight to the class of metal produced in Europe.

Dr. Wuest holds that the charcoal irons which could be used for malleable purposes are entirely too high for crucible purposes. If steel scrap were added this should be easily remedied. He gives the analyses of 50 pig irons both English and domestic which enter into the malleable industry of Germany. The range of the elements is given herewith.

Total carbon	2.80	to	4.50
Silicon	.21	to	1.97
Manganese	.11	to	.86
Phosphorus	.038	to	.155
Sulphur	.008	to	.553

MINING ENGINEERS DISCUSS IRON.

The first session of the A. I. M. E. meeting at Atlantic City was devoted entirely to cast iron. Dr. Moldenke opened the discussion by giving the substance of his paper on the history of the movement toward specifications for cast iron and finished castings. This was followed by a paper on the use of machine cast pig iron, together with the proposed specifications for Pig Iron, by Mr. Cook, president of the Warwick Iron & Steel Co. These matters have already been discussed previously in *The Foundry*. A very spirited debate followed, in which on the side of the blast furnace it was contended that if the foundryman knew how to use his iron properly there would be no trouble resulting from the iron sent to him. That the furnace could be counted upon to send along irons which would fit the requirements of the foundry once they were known. That the foundryman was apt to call for too low sulphur and too high silicon, while if he paid more attention to the proper melting of his irons this need not be so, and hence he could use cheaper irons.

From the foundry side it was freely admitted that not all foundrymen melted their iron with the degree of care this should have. That they had so much difficulty in getting fuel with low sulphur content, that it was imperative to get the best compositions in the irons in the first place, for fear that otherwise the product would suffer if the coke were bad. It was rejoined that the more liberal use of anthracite would mend matters considerably.

The further point was brought out that the average foundryman could take the furnace advice without hesitation, but the maker of special lines could not. He must learn everything that he could about the iron to go into his work, and hence his specifications would naturally be very strict. The subject of oxidation of the metal was threshed out pretty lively, and the furnaces were asked to keep right on improving their methods, as the foundry could not improve the iron they got, but if anything, deteriorated it, as the remelting processes were all hard on the product.

The specifications then came up for discussion, and seemed to find general approval. While the furnaces would like to have seen a more liberal sulphur limit, yet as it is possible to meet this in almost all irons in the

market, it was not pressed. The absence of phosphorus and manganese from the specifications was explained by the universal custom of the makers of special lines of castings to stick to given varieties of irons in which these elements were practically constant. So also with the total carbon, which for American irons was a pretty uniform matter. It was not of much account anyhow, as the first thing a man does in the foundry when he wants strong irons is to add steel scrap, which accomplishes his desire by reducing the total carbon in the castings.

The next subject taken up was that of the general specifications for testing cast iron. Mr. Souther, the chairman of this sub-committee, read a paper on the subject in general, and added the specifications advanced. He described at length the tests that were made and upon which the figures adopted were based, and pointed out that the most important thing was after all the method of preparing the test bars. Hence the specifications were very explicit about this, and it was found that wherever the foundryman attempted to take a short cut, the result suffered. Where the specifications were followed, there was no difficulty in getting concordant results every time.

The tensile test was severely criticised by practically everybody present, and this primarily on account of the impossibility of getting an absolutely aligned pull on testing machines in every day use. Hence the specifications also call for the transverse test as preferable.

There were other interesting points brought out in the line of foundry practice, one especially on the relatively greater burning out of manganese than silicon, where the percentage of the former is higher, thus protecting the silicon during the melt. The remarkable change in foundry methods to more scientific lines was also freely commented on, and much good for the future predicted. The meeting then adjourned to the afternoon.

Complete foundry equipment is required by the Gartland Foundry Co., of Terre Haute, Ind., for a foundry 112 by 310 feet.

The Angola Engine & Foundry Co., of Angola, Ind., recently increased its capital stock from $20,000 to $50,000.

The Marion Machine, Foundry & Supply Co., of Marion Ind., has increased its capital stock from $25,000 to $35,000.

MILWAUKEE COKE & GAS CO.

The Milwaukee Coke & Gas Co., Milwaukee, Wis., has opened an office at 800 Fisher building, Chicago, in charge of Morton Otis, for the sale of Solvay foundry coke, etc., in the Chicago territory. Mr. Otis will be assisted by Clarence M. Schwerin, formerly assistant general superintendent of the St. Paul, Minn., plant of the Griffin Wheel Co., who has had considerable experience in cupola practice. The company's by-product ovens, works and storage yards, etc., are located on the tracks of the Chicago & Northwestern and Chicago, Milwaukee & St. Paul railways, at Milwaukee, where, owing to their advantageous location, prompt deliveries of its product can be made to any point in the States of Wisconsin, Illinois, Minnesota, Iowa and Michigan. For the benefit of the Chicago trade, storage yards have been established at 221 North Branch street, on Goose Island, in that city, where the company will have on hand in addition to foundry coke, all sizes of crushed coke, carefully screened for forging, cooperage work, brass foundries, etc. Foundries or manufacturers not having their own sidings or facilities for the storage of large quantities of coke at their plants will be supplied with lots of one ton up either in their own or the company's wagons, special facilities having been made at the yards for the accommodations of team trade. The company states that it has a large market for crushed coke not up to first foundry grade in structure and analysis, and that foundrymen will be supplied only with a selected, uniformly strong, fast and hot melting coke containing practically no breeze.

The American Car & Foundry Co. has given employment to 200 men in its plant at Detroit, who had been laid off since the beginning of the year.

The Racine Steel & Iron Mfg. Co., of Racine, Wis., has made application to change its name to the American Skein & Foundry Co.

The Babcock & Wilcox Co. have erected a new foundry at Bayonne, N. J. Thus far they have been purchasing castings from various parties.

The Baldt Steel Co., manufacturers of steel castings, will begin operations at its new plant at Newcastle, Del., May 1.

The Creston Scale, Foundry & Manufacturing Co., of Creston, Ia., have been incorporated with a capital of $20,000.

ASSOCIATIONS AND SOCIETIES.

American Foundrymen's Association.

DR. RICHARD MOLDENKE, SECRETARY, WATCHUNG, N. J.

The annual convention of the American Foundrymen's Association will be held on Tuesday, Wednesday and Thursday, June 7, 8 and 9, in Indianapolis, and on Friday, June 10, in St. Louis. The members are assured of a hearty welcome in both cities and it is hoped that there will be a large attendance. All who can read papers or take part in the discussion should communicate with the secretary, Dr. Richard Moldenke, as soon as convenient.

The Philadelphia Foundrymen's Association.

HOWARD EVANS, SECRETARY, CARE OF J. W. PAXSON CO.

The 136th monthly meeting of the Foundrymen's Association, was held at the manufacturers' Club in Philadelphia on Wednesday evening, March 2, the president, Thomas Devlin, occupying the chair.

The treasurer reported a balance of over $2,000 in the treasury, and all bills paid.

The secretary read a communication from Dr. J. A. Holmes, chief of the Department of Mines and Metallurgy, St. Louis World's Fair, stating that the exposition authorities would erect the building necessary to contain the proposed model foundry exhibit. On motion E. E. Brown was elected to represent the association at the exposition.

Fuel Economizer

The paper of the evening was by A. H. Blackburn, of the Green Fuel Economizer Co., Matteawan, N. Y., on the "History and Advantages of Green's Fuel Economizer."

In Mr. Blackburn's paper he gave a general review of the history of the Green Fuel Economizer and then stated the various uses to which it can be put and the advantages to be derived from it. It was a very interesting and instructive paper, including as it did the savings which could be effected with coal at different prices per ton and the manner in which waste gases from furnaces and boilers can be used. At the conclusion of the paper a unanimous vote of thanks was tendered Mr. Blackburn. There was no discussion of the paper.

The "Quiz" class presented several questions. The first was, "What amount of moisture is there in molding sand, when properly prepared for use?" The general consensus of opinion seemed to be that this matter should be left to the molder's judgment. It was pointed out, however, that the weight of a given volume of molding sand varies greatly with the moisture which it contains and hence it would pay to buy molding sand in August and September, and the fact was mentioned that one large concern had arranged for storage for a sufficient volume of sand so that they could have all of their sand dug during those two months.

Another question was, "How long should the wood fire in a cupola be lit before the blast is put on?"

Mr. Harkins—I think the time should be long enough to get a good fire, then put in the iron and start the blast at the same time.

H. O. Evans—The iron should be put in when you see a red fire from the bed.

Mr. Smith—In my apprenticeship days it was the shop custom to work two or three days, until the shop was as full of work as possible. Our old foreman would then go to the cupola, put in his wood, coal, and iron, and load up to the charging door. He then would light the fire and put the blast on; and I never saw hotter iron than we then got. I know it is the custom in many foundries to light the fire and let it burn up until the coal gets cherry red, when it is supposed to be time to charge. Sometimes, however, it is found that the wood is wet and burns up slowly. Wait until the coal gets cherry red, seems to be the rule. We never found it necessary to wait a minute. We just lighted the fire and while it was burning up we put in the iron, turned on the blast and got as hot iron as at any time in my experience.

E. E. Brown—In our practice we have tried every scheme. Now, as soon as the fire shows through the coke we commence to charge and get better results than in any other way. It is only a few minutes before we put the iron in.

Mr. Kelly—In stove foundries the practice is to get the cupola ready, put the bed in, and light up about 10:30 or 11 o'clock; then let it burn until we see the fire coming through the bed, when we charge. It is frequently 2 o'clock before we put on the blast.

Mr. Hunt—We make our bed, and charge our iron up to the door. After lighting we let the fire run for about two hours before we put on the blast. Our iron comes down pretty hot.

Mr. Smith—I cannot see what is to be gained by waiting so long. You are certainly

wasting the bed. I think the backbone of the heat is the bed.

Mr. Devlin—The wood is used for no other purpose than ignition of the coal.

Proper Blast Pressure.

A third question presented was, "What is the best way to determine the necessary pressure of blast for a cupola?"

Mr. Steel—I think the amount of air you are getting is more important to determine. It is important that the tuyeres be large enough and open enough to get a good volume of air. I have melted better with low pressure than with high pressure.

Mr. Haldeman—In blast furnace practice we find it necessary to know how many cubic feet of air we are using. Volume is very important, and it must also be so with the cupola.

Mr. Davis—Some years ago in watching operations in large cupolas I gave considerable attention to the pressure gauges in connection with a positive pressure blower. The pressure rose during the day, which showed that the tuyeres got more or less stuck up during the heat.

H. O. Evans—It is a question of volume entirely rather than pressure. You will find the pressure vary during a heat. I have never been able to get good results in our cupola under 14 to 16 ounces pressure.

Mr. Shennan—We have put in a new plant, with two cupolas. We have tried different tuyeres, pressures and volumes, and have certainly found that it is not volume alone that melts the metal. There must be some pressure back of it. The fuel used must also be taken into account. I have used 12 ounces pressure on one kind of coke, and found 9 ounces on another kind quite sufficient. The cupolas are large and I found many conditions depending on the stock. With coarse scrap, for instance, you can melt with less pressure.

Mr. Devlin—I agree with you that a good deal depends upon conditions. With strong pig iron and a lot of sprues mixed in you require more volume.

Mr. Shennan—Yes, and more pressure to get through the mass.

H. O. Evans—If you will study your melting zone you will be able to regulate your melting blast.

Mr. Brown—Our experience teaches us that pressures have nothing to do with the melting.

Mr. Shennan—It is proper combustion you want and you must have volume and pressure to get that. You may start out at 10 ounces and by the time you get near the end of the heat you will find your pressure gets up to 14 ounces.

Mr. Kelly—Our blowers are really air pumps, and we get volume with very little pressure. We start with about 8 ounces and gradually get up to 12 and 14 ounces.

The members, after adjournment, enjoyed a planked shad luncheon in the banquet room of the club. With speeches following, the hour was late before the members left for their homes.

New England Foundrymen's Association.

FRED F. STOCKWELL, SECRETARY, CARE OF BARBOR-STOCKWELL CO., CAMBRIDGEPORT, MASS.

The regular monthly meeting of the New England Foundrymen's Association was held at the Exchange Club, Boston, March 9, at 4:30 p. m., B. M. Shaw, president, in the chair. The routine business was dispensed with in the usual manner, after which several new members were elected.

At the afternoon session Herbert E. Field, of Ansonia, Conn., secretary of the metallurgical section of the American Foundrymen's Association, gave an interesting address on "Defects in Cast Iron; Their Causes and Remedies." Much information of value was brought out in the discussion that followed, which was participated in by Messrs. Kreuzpointner, Field and Doherty.

Dinner was served at 6 o'clock, after which the evening session was addressed by Mr. Paul Kreuzpointner, of the Altoona shops of the Pennsylvania Railroad Co., Altoona, Pa., on "Trade Education for the Foundry." This paper was also discussed at some length, Messrs. W. W. Bird and C. L. Newcomb participating. The speaker exhibited specimens of castings made by a 12-year boy in one of the trade schools and they proved very interesting to those present.

Pittsburg Foundrymen's Association.

F. H. ZIMMERS, SECRETARY, CARE UNION FOUNDRY & MACHINE CO.

At the meeting of the Pittsburg Foundrymen's Association, held at Pittsburg, on Monday evening, March 7, Thomas D. West, of Sharpsville, Pa., read a paper on "Fan Power for the Cupola." The questions taken up by Mr. West proved of intense interest to all present and a lively discussion followed the reading. It developed that there was no fixed

NEW YORK FOUNDRY FOREMEN. TAKEN AT NEWARK, N. J.

method of ascertaining the power for driving a fan under the variable conditions connected with cupola practice and there was a wide divergence of opinion on the subject of piping. In addition, the rotary pressure blowers had their supporters and numerous experiences were related, no two being alike. Owing to the interest manifested in the subject it was decided to gather additional information and a committee of three, consisting of Thomas D. West, W. H. McFadden and A. O. Backert, was appointed for the purpose of securing the experiences of foundrymen all over the country on the use of fans and blowers for operating their cupolas, with a view of later arriving at some formula that can be used by all foundrymen for ascertaining the power they require under all conditions. An effort will also be made to arrive at some definite conclusion as to the efficiency and economy of using a blower in the place of a fan and vice versa. One large foundry in Pittsburg using a fan will permit the use of its cupola for the making of these experiments provided a pressure blower can be secured. It is the intention to make these tests under exactly the same conditions, and it is believed that information of great value to foundrymen in general will result from these investigations and experiments. Lunch was served after the meeting.

New York Foundry Foremen.

F. C. EVERITT, CARE J. L. MOTT IRON WORKS, TRENTON, N. J., SECRETARY.

On Jan. 30th the foundry foremen from the vicinity of New York met at Newark, N.J., as was mentioned in last month's Foundry, and we are glad to present herewith a halftone taken on that occasion, which unfortunately reached us too late for publication in the March Foundry. Owing to the lateness of the hour, a permanent organization was not completed at the first meeting and a second meeting was arranged for.

The second monthly meeting was held Feb. 27, 1904, at the Imperial Hotel, Jersey City, N. J. The notices received a hearty response and the meeting was greatly strengthened by the presence of Dr. Richard Moldenke, who gave a very instructive talk on foundry operations and finances, presenting various points of value to be brought up for discussion. Many questions followed and some very interesting discussions resulted.

A paper was prepared and read by one of the members, F. C. Everitt, on "Our Interest in the Local." The object being to impress, if possible, upon each one present the necessity of such an organization for the advancement of foundry practice, the advantages to be deriver therefrom, and the hearty support needed from each member.

The enthusiasm shown throughout the meeting was indeed encouraging. The necessary business was transacted and officers elected. Mr. Chas. H. Thomas, president of the A. F. F., was elected president, and Mr. F. C. Everitt, of the J. L. Mott Iron Works, secretary. The plan of preparation to be made for future meetings was briefly outlined, particular attention being given to the matter of preparing articles to be read and opened for discussion.

A number of new members were obtained and there is every prospect of greatly increasing the number in the near future. The meeting was adjourned at 9:30 and a very substantial collation was served.

The Associated Foundry Foremen.

JOSEPH A. MURPHY, SECRETARY, 114 WEST TWENTIETH STREET, ERIE, PA.

Erie Foundry Foremen.

HARRY E. KIES, SECRETARY, CARE OF ERIE MALLEABLE IRON CO., ERIE, PA.

Chicago Foundry Foremen.

GEO. C. NIELSON, SECRETARY, CARE OF HENRY E. PRIDMORE CO., CHICAGO, ILL.

Milwaukee Foundry Foremen.

THOMAS GLASSCOCK, SECRETARY, CARE OF PAWLING & HARNISCHFEGER CO., MILWAUKEE, WIS.

Indianapolis Foundry Foremen.

JOHN REYNOLDS, SECRETARY, CARE OF ENTERPRISE FOUNDRY & FENCE CO., INDIANAPOLIS, IND.

Sale of a Historic Foundry.

An old plant in New York which was formerly the James & Kirtland Iron Foundry on 150th St., was sold recently. It is no longer a foundry, but with it passes one of the historic foundries of the country. It is said that in this plant all the castings for the dome of the capitol at Washington were made. Some of the bridges and castings for the Mall, in Central Park, as well as outside iron work for the Congressional Library in Washington were made here. During the Civil War when it was feared that the Confederate army would reach Washington the iron door and shutters for the capitol were made at this foundry at a week's notice, so as to help fortify the building against attack. Many castings of noted structures were made in the old foundry.

CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and Using Cast Iron. Address all inquiries to W. J. KEEP, care of The Foundry.

Slagging a Cupola.

Question. We are having trouble with the slag in our cupola. I would like to know what relation the size of the slag hole would be to the spout hole and what time in the heat you tap the slag hole? At what height do you put the slag hole and what amount of flux is required to slag the cupola properly when using the slag hole?

What is your opinion of fluor spar as a flux as compared with limestone?

Answer. Both the tap hole for iron and for slag should be of such a size that a continuous stream will run throughout the heat. Just as soon as slag comes out with the iron, or blast comes out of either hole, you will know that it is too large.

It is not an easy matter to keep either of these streams continuous.

If the bottom of your tuyeres is about 12 inches above the sandbottom the slag hole should be about 4 inches below the tuyeres and should be about one inch in diameter made hard with fireclay.

Fill the hole with ordinary molding sand and stop the inside and outside with about ½-inch thick of fireclay.

In charging use about forty pounds of limestone to each ton of iron charged and place it on the coke. Do not use any lime on the first two or three charges and do not open the slag hole until you have taken out about ten tons of iron.

Work a hole through for the slag and have it run over a clay lined trough to the ground so as not to be in the way of the bottom when it is drawn out.

After the slag has run a little while a crust will form on the top of the stream. Raise this crust an inch or so with a bar and hold until it stays there. This will form a covered stream of slag which will run for hours and even if the blast does come out it will make no noise for it will be under this cover—If it is necessary to break the crust near the hole it will soon bridge over again.

It takes about half the amount of fluor spar as lime and it is a better flux, but there is so little difference between oyster shells, marble chips, limestone or fluor spar that whichever is cheapest is best.

Core Making.

Question. Which is the most economical way or method known to produce dry or green sand cores from 2½ to 4 inches in diameter and from 2 feet to 7 feet long?

Answer. For dry sand cores use the core machines advertised in THE FOUNDRY, and use rosin for a binder. For green sand cores the method used by makers of soil and water pipe is best.

A hollow perforated center is revolved under a falling sheet of tempered sand. A steel plate cuts off any surplus. When the core is complete the machine is stopped and the core lifted out and placed in the mold. At the same shops you can see the rigs for making cores for elbows and short pipes.

Blowholes in Castings.

Question. I would like to know the cause and remedy for small holes in castings? For instance, take a casting 4 inches x 6 inches with two ends about 2 inches deep, all ⅛-inch thick. These castings have to take a very high polish. When we cut the surface down we come to a pinhole and start to cut it out but it becomes larger and a good many times we have to throw the casting in the scrap. One man tells me that it is sulphur; the chemist says the sulphur is .2. The next one says it is gas and your sand is too close, but I have used coarse sand and find it no better. Another says riddle the sand with a 14 or 16 riddle, but the holes come just the same.

I think it is in the iron, for if you break a pig on the top side you will find just the same kind of a hole or a good many of them and some as large as ½-inch diameter.

I refer to the No. 2 pig iron that we use. Our own scrap is from 40 to 50 percent of our mixture.

Answer. The remedy for such holes is to pour your iron hot. You should also have about 1 percent phosphorus in the iron for such castings and have the silicon about 3 percent. This will make the iron very fluid and give time for gas to escape. The reason that you do not find these holes in pigs with high silicon or high phosphorus is that the gas had time to get out.

No. 2 pig lost its life before it filled the pig bed and a crust formed before the gas escaped. The chemist must have said that sulphur in the pig with holes was .02. In your castings it will be nearer .08.

You can try a piece of aluminum in each ladle about ½ inch square or if you can get some ferro-manganese use about the same quantity crushed fine.

Of course all the above suggestions are good. Good venting and hot iron will stop the holes. Why don't you mold the piece so that the polished side will be down?

Hot Iron and Blast Gauge.

Question. What is the correct blast pressure for ordinary melting to secure very hot metal? Who makes a water column that will indicate high blast pressure?

Answer. The heat of the metal depends upon the care in charging and the quality and quantity of coke. The speed of melting depends upon the amount of air blown. For fast melting of hot iron the coke ratio can be as high as 9 to 1 in a cupola lined to 64 inches and melting 35 tons and a pressure of 16 ounces will melt 12 tons per hour.

It is said that each ounce increase in pressure would mean one extra ton per hour. I have found that there was no gain after 20 ounces and small gain after 18 ounces. Fourteen ounces was the old-time pressure with fan. Take any old airtight iron tank that will hold 5 to 10 gallons and set it below frost line in the ground. Have an inlet through the top to fill and another admitting air from blast pipe. Screw in a 3-inch gas pipe to reach very near the bottom and let it extend four or five feet above ground. Make a copper float to fit loosely in this pipe and to its top fasten a ¼-inch round pine rod. Arrange a pointer that can be moved on the rod and a scale behind it. Fill the tank with water until the float rises a few inches and close the feed pipe. Put a mercury gauge in your blastpipe and put on your pressure very slowly marking off the water gauge to correspond with the mercury. When you have a few correct markings you can extend the scale as high as you wish. The tank will not need refilling. You can test every few years and move the pointer if needed.

NOTES ON CUPOLA PRACTICE.

BY CLARENCE M. SCHWERIN.

The following notes are presented as a few essential points to be noted by the man in charge of a cupola in order that he may turn out his work with a minimum of loss. When long heats are to be run, as, for instance, when 100 to 130 tons of iron is to be melted in from six to eight hours, one of the most important matters to be considered is cupola brick lining.

Lining.

When putting in a new lining it is advisable to use arched block brick from the bottom door to the top of the charging door. A lining of ordinary square and arch brick is, however, frequently found to give practically as good service. In all cases square and arched brick may be used from the top of the charging door to the top of the stack. It is advisable in all cases to line the space between the charging door and a point one or two feet lower down with arch block brick; these usually need patching and partial replacing about every six weeks. The entire lining from the bottom door to the charging door will need replacing about every three months. The stack lining should remain in serviceable and safe condition for at least three years. The brick should be laid in a mortar of good fire clay.

Each morning, upon entering the cupola to patch the lining for the day's work, it will be found that accretions have formed over the tuyeres, thus blocking up the cupola and partially bridging it over. All these accretions must be broken off flush with the brick lining. Picks of various shapes and weights are used for this purpose, though very frequently a steel bar and sledge are necessary. After the cupola has been "roughed out" and all projections have been removed, it will be seen that the brick lining has been more or less eaten into at points. This depends in a great measure upon the kind and quality of coke that was used the previous day. It is necessary to fill in all the eaten out places with brick set in a mud made of one part good fire clay and two parts good molding sand. If either clay or sand is not of the best quality, it is better to use equal parts of each.

Too much attention cannot be paid to the proper patching of the lining, as this is exceedingly important. If too much mud is used and not a sufficient quantity of brick, the patching may appear to be all right upon inspection, but, nevertheless, cutting is very apt to take place somewhere after the middle of the heat. The brick used for filling in eaten out places should be split and shaped in such a way that they will fit the holes closely. It is poor economy to save time and brick by hastily slapping in mud. The cupola is said to be cutting when the lining begins to be eaten out, allowing a direct upward passage for the blast. Cold hard iron will be the result if cutting takes place, pro-

vided proper precautions are not taken to avoid bad results.

Cutting may be detected by the appearance of reddish yellow flame at the charging door, replacing in part the normal blue flame; by iron sparkling at the slag spout; by the blocking up of one or more tuyeres, and by the smoke issuing from the stack turning from ordinary gray to reddish brown. Cutting is one of the most serious things that are likely to occur ordinarily in a heat and is very apt to produce bad results.

The Bottom.

In putting in the bottom post, care should be taken not to wedge it so tightly that it would be impossible to pull the post or drop the bottom without first tapping it with a sledge. When it is necessary to use the sledge on the bottom of the post it exposes the workman who does this to great danger. It is well to set the

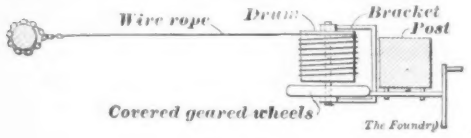


FIG. 1.

post with the ring turned on the chain a little to one side and the chain wrapped around the post and then attached to a small winch, as shown in Fig. 1. The post should, however, be so tight that the bottom doors cannot sink when charging begins, for if the bottom doors do move, the sand bottom is apt to crack and result in a run out during the heat.

A good bottom can be made by using good molding sand and ramming it to a depth of two inches, then ram in the same depth of heap sand. It is a good plan to spread some cinders in a flat conical pile in the middle of the bottom before putting in any sand.

Starting the Fire.

For lighting the fire it is advisable to use 5 or 6 inches of shavings upon the bed. The wood used for lighting the bed of coke should be neither too large nor too small. Anything from 2 to 4 inches thick and from 4 to 10 inches wide will give satisfactory results. If smaller pieces are used they burn out before the bed of coke is properly ignited and it will take much longer to burn the bed to the right color. If too large pieces are used they will not burn up in time and will later on cause the bed to give way and drop when they are completely consumed.

About one-third to one-half of the bed charge of coke should be used on top of the wood in "burning up the bed;" ⅔ of this should be put on top of the wood before any fire is lighted and the other portion should be used for feeding up, i. e., filling in spaces that show themselves when the wood begins to burn away. The first portion of the bed should be burned to a bright cherry red in order to insure good hot iron for the first few taps. It might here be noted, however, that hardly any two men burn to exactly the same color. The bed charge of the mixture must be regulated somewhat according to the way in which the bed is burned, for burning to a bright color will give a hotter and therefore a softer first tap than will result when the last part of the coke for the bed is charged before the first is burned up to a bright color. With this method the blast is put on when the cupola is full.

Making up the Charge.

When calculating the iron mixtures, 4 and sometimes 5 important things are to be considered; there are the silicon, manganese, sulphur, grade, and for certain work, phosphorus. In many cases the phosphorus will take care of itself. The calculated results should be checked by chemical analyses of the casting, aside from physical tests. By combining steel and soft coke irons, often the same results may be obtained as in the use of expensive charcoal iron.

Malleable scrap of all kinds may be used with perfect safety up to 8 or 9 percent, even when making casting for very severe service, such as car wheels. Cast scrap and stove plate may also be used with perfect impunity.

Grade, to my mind, other things being equal, is largely a matter of total carbon content and can be regulated by the proper combining of pig iron, steel, malleable scrap, cast scrap, including old wheels, stove plate, etc. Regular and uniform good results can be obtained when using scrap mixtures.

Temperature of the Iron.

In attending a cupola the temperature of the iron should be closely watched. As soon as the iron shows the slightest appearance of becoming cold, several things should be considered immediately. If the test pieces are normal, the tuyeres bright and no appearance of cutting is seen, put on an increased quantity of coke, say 100 pounds extra, for a couple of charges and increase of 25 pounds on every charge, which will usually be sufficient. If, however, any of the tuyeres show signs of blocking up and the flame at the charging door

begins to show yellow, 200 to 400 pounds of coke should be used immediately over the place which is cutting, and extra coke should be used for a while in every charge or every other charge. The amount of extra coke to be used will depend on the amount the furnace is departing from its normal running and will have to be determined according to the requirements of the case. If extreme cutting is taking place and the bed begins to drop, allowing the melting to be done too low, it will be found that lowering the blast pressure from 2 to 4 ounces in addition to adding the coke will do much toward saving the heat.

The Blast.

In putting on blast at the beginning it is a good plan to do it gradually; if 15 ounces blast pressure is used during the heat, 10 ounces might be used for the first 10 to 20 minutes, 12 ounces until the first iron appears and full blast pressure after the first tap is made; also after the last charge is on for the day, the blast should be lowered 2 to 3 ounces. A point to be noted in this connection is that even though the wind gate is not again changed and the fan remains at the same speed, the air pressure shown by the gauge will gradually become less as the charge sinks. This indicated lowering of pressure is probably due to the diminished resistance offered to the blast in its passage upward and may have no bearing upon the volume of blast furnished.

Coke.

When the supply of good strong coke is limited, it is a good plan to keep the strong coke for the bed and use the poorer quality during the heat. Frick's 72-hour Connellsville coke of good quality was considered standard for good foundry coke. The United States Steel Corporation took the entire supply for the year 1903, and it was necessary for all foundries to use other kinds. It is possible to get good results even with low ash cokes like the "New river" and "Pocahontas," soft cokes running around 6 percent of ash. Rather than run a low ash coke alone, it is much better to mix the low ash and the high ash cokes if the supply of the latter will permit of so doing. It is not necessary to actually mix the cokes before charging, it being sufficient to simply charge each kind in alternation in the proportion determined.

In this connection it might not be amiss to mention that Solvay by-product coke is usually of excellent quality and gives very satisfactory results, even though it is lacking in the pretty silver sheen which some short time back was considered to be an absolutely rigid requirement for a good foundry coke. As a rule a better melting ratio may be obtained with Solvay coke than with any other brand.

Advantage of Analysis.

It will be found true economy to analyze all materials charged into the cupola. In the first place, it is then possible to know exactly what is going in, thus allowing poorer and cheaper material to be used, as the factor of safety for good running need not be so high. By this it is meant that it is not necessary to trust to luck to get good results, for the man who is responsible can know exactly what he is doing. As a parallel illustration one might consider the building of a bridge, in which every detail was carefully figured, and the building of another by rule of thumb. The question is if the builder was to be absolutely sure that both bridges would carry the load, which one would require the most material?

Another advantage of analyzing everything is that when this is done, if any trouble occurs, it can be located much more easily.

Charging.

The manner in which a cupola is charged has much to do with the results. All coke should be carefully leveled. In charging iron care should be taken to see that it is done as evenly and compactly as possible. All holes between the large pieces should be filled in by small pieces of scrap so that the blast may pass up evenly, thus avoiding irregularities and local Bessemerizing.

Mr. William T. Taylor, of Oklahoma City, Oklahoma, has purchased the Wayland Machine Shops, of Oklahoma City and is planning to add a foundry to the plant.

Daniel Dow, proprietor of the Grand Forks Foundry & Machine Shop, Grand Forks, N. D., has decided to establish a branch in Winnipeg, Manitoba. The building has been rented and the plant will soon be in operation.

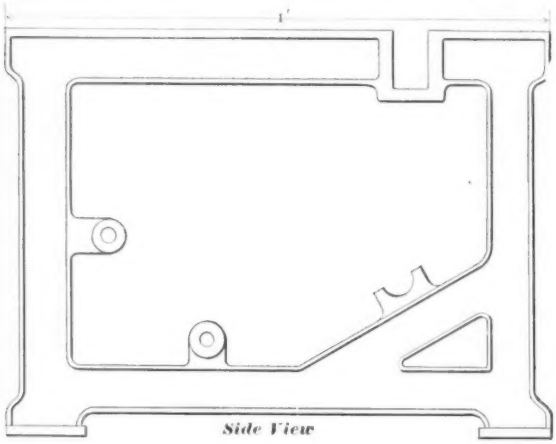
The Norton Foundry Co., of St. Louis, Mo., has been incorporated with a capital of $25,000 to manufacture mining machinery, etc. The plant is to be built at Norton, N. C.

The Chicago, Rock Island & Pacific Railroad Co. has made a contract with the Berry Foundry & Mfg. Co., of St. Louis, Mo., for all the castings needed for the system west of the Missouri river.

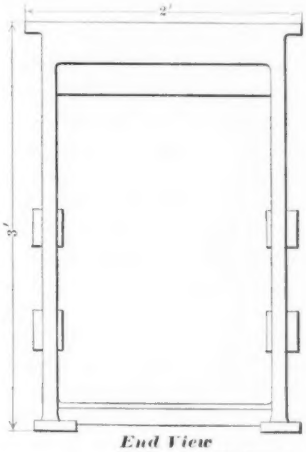
MOLDING A PRINTING MACHINE FRAME.

BY GEO. BUCHANAN.

The required casting is shown in Fig. 1. Previously this frame was made as four separate castings, that is, two side frames and a top and bottom piece. Suitable faces were cast on each piece and these faces were machined after which the pieces were bolted together. In this way a frame was produced similar to that shown in Fig. 1. The principal dimensions are length, four feet; width, two feet; height, three feet. The weight is 800 pounds.

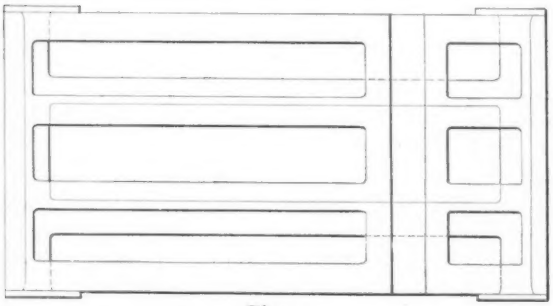


Side View



End View

The Foundry



Plan

Fig. 1

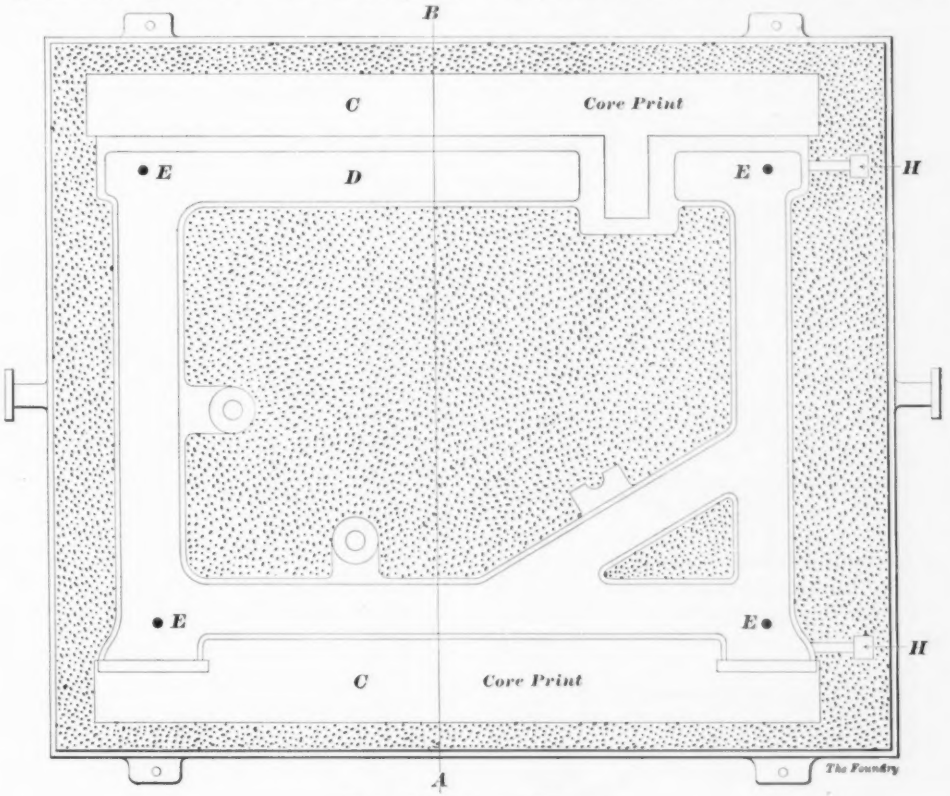
This casting, which forms the principal piece of a multi-color printing machine, is a rather closely cut line of business and it was in order to try and save a little in the machine shop that the main frame was made in one piece.

In preparing the pattern for the new method of molding, the two slide frame patterns formerly used were utilized. These were held together by two core prints, as shown in Figs. 2 and 3. These Figs. show a plan and sectional view of the flask, with the pattern set in position. The core prints C-C are made full width of the frame and the side frames D-D are fastened to the prints. The bottom frame being located by four pins and four screws shown at E-E. The two core prints C-C are tapered at the sides and back to enable the cores to be lowered into their places easily and to avoid breaking the sides of the mold. Referring to Fig. 3 it will be noticed that the prints C-C have portions cut out for their full length, as shown at F-F. The reason for this will appear later in the description of molding.

Two core boxes (not shown) are required to complete the equipment. The interior of the core boxes must be made to correspond to the form of core prints C-C. These boxes also contain patterns for forming the top and bottom portion of the casting. The core boxes are so constructed that the patterns lie on the bottom of each box, thus leaving the top open for ramming and for the setting of the core iron. The core irons are simply flat grids having suitable prods cast on them. These prods are carefully spaced so that they will support the sand around and between the various parts of the pattern. In making the cores, the method is to fill the core boxes about three-fourths full of core sand and then force the core iron into the box until the right position is obtained. Of course it is

necessary at first to try the core iron in the box and see that none of the prods come in contact with the pattern. After the core iron is in place the box is rammed full and vented. The venting is done after the box has been struck off level and is performed by means of a suitable vent wire which is pushed through the space in the back of the core grid and to within one-half inch of the face of the pattern. The cores having been finished and blackened on their essential parts are placed in the stove (core oven).

When molding this frame in a single piece, the various pieces of tackle previously used were utilized as far as possible as in the case of the patterns already mentioned. It was found that the top and drag parts of the flask were sufficiently large to take in the pattern.



Plan of Drag and Pattern
Fig. 2

In molding, the side frame is first placed on a turn over board and the drag portion of the flask rammed up and turned over. The top frame and two prints are then placed in position and secured by means of pins and screws as shown in Figs. 2 and 3. The middle part of the flask is next lowered into position with the crane. This part of the flask consists of four plates cast in open sand and securely bolted together. Of course it must be provided with the necessary flanges, lugs and guide pins. Two plates are also cast with holes or slots in them as shown at G-G Fig. 4. After the middle part has been placed on the joint, four bars are slid through the holes and wedged tight on each side of the flask. Gaggers are hung from these bars to carry sand in the center of the box. Two bars are also placed under the core prints C-C at F-F Fig. 3. The ends of these bars rest on projections in the middle part of the flask. The bars must be wedged tight against the prints at F-F.

After placing the gate pins H-H the ramming up is proceeded with and the top frame tucked under and vented. The joint is made and the top or cope part of the mold rammed up in the usual manner.

The cope is then removed, the screws taken from the pattern and the top frame is drawn. Next the two side prints are hoisted out. The

cores are then lowered into the place previously occupied by the core prints. Care should be taken first to measure the cores before lowering them so as to make sure that

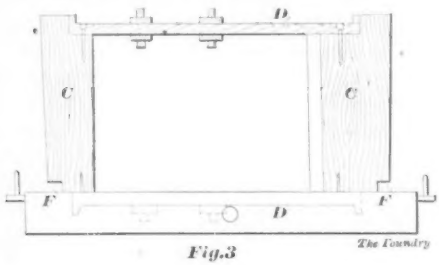
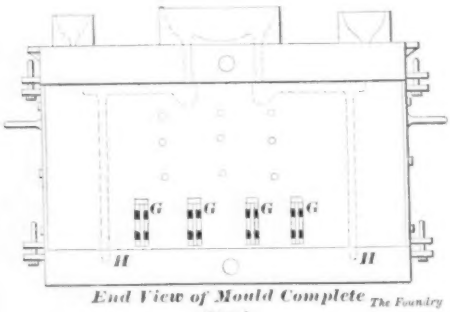


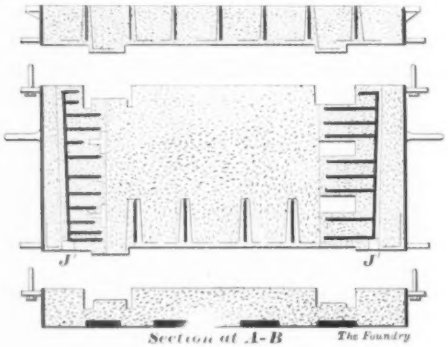
Fig.3

they will fit accurately and come to rest upon the bars at F-F. The middle portion of the flask is now lifted off and its lower face finished, the cores being held in place by the bars already mentioned.



End View of Mould Complete
Fig.4

A sectional view of the mold on the line A-B Fig. 2 is shown in Fig. 5. The parts are shown separate and the cores set. The bars which hold the cores in place are shown at J-J.



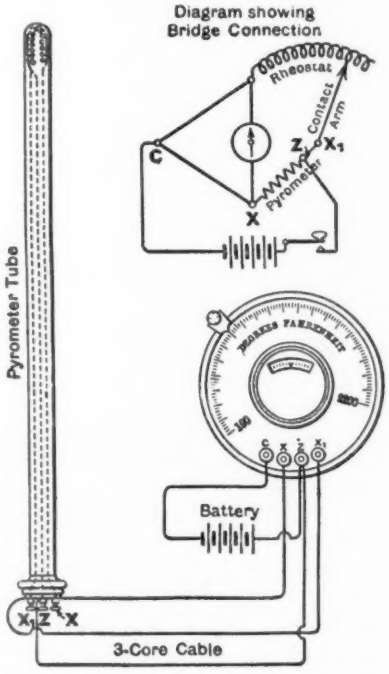
Section at A-B
Fig.5

After the drag has been finished, the middle is lowered over it, the gates having been attended to first. The top part is now replaced and four clamps wedged on, one at each corner. The runner and risers are then made up, which leaves the mold ready for the metal. Fig. 4 shows the method used in gating this piece. After pouring and before removing the casting from the flask the four bars at G-G Fig. 4 are removed so that the casting can be lifted out of the flask without difficulty.

The first casting made by this method took longer than had previously been taken to make the four separate pieces but by the time the third casting was made the time was the same as by the former method, so that a saving was effected on this order, which called for 24 machines.

AN ENGLISH PYROMETER.

A description of an English pyrometer is given in the *Electrician*, of London. A coil of platinum wire is wound upon a cylinder of refractory material and usually fixed at the end of a long closed iron tube. The coil is protected by a platinum shield and measure-



ments of the electrical resistances of the coil are taken in order to determine the temperature. Two different arrangements are employed for this purpose. One consists of a differential galvanometer and a set of resistance coils, the combination submitting readings in ohms and the corresponding tempera-

tures are then obtained by the use of special tables. The other arrangement is illustrated and comprises a galvanometer of the d'Arsonval type and a Wheatstone bridge with circular rheostat giving readings in degrees of the thermometer. Accurate results are claimed for both methods in the principal field of application; iron, steel and similar processes, where the temperature has to be closely watched and regulated. It is stated that in the case of the first instrument, briefly described above, a change of the resistance from 10 to 44.9 ohms corresponds to a rise in temperature from 58 to 2,204 degrees Fahrenheit.

New Books.

The editor-in-chief of the Technolexicon, which is a new dictionary being gotten out by the German Engineering Societies and is to be printed in English, German and French, has sent out a notice stating that they have received a large number of notebooks filled out with technical words and other information which has enabled them to classify 1,920,000 words. They expect that there will probably be at least 100,000 more words before the work is completed. They wish to have all outstanding contributions in by Easter, '04, and if any one wishes to contribute any matter for this publication they should send it to Dr. Hubert Jansen, Technolexicon, Berlin (NW. 7), Dorotheenstr. 49. Germany.

Foundry Nomenclature. By John F. Buchanan. Published by E. & F. N. Spon, London, and Spon & Chamberlain, of New York City. Price, $3.50. This book is divided into three parts. The first 113 pages are given up to a foundry dictionary. This is followed by a section of about fifteen pages of foundry phrases and maxims, and the balance of the book is taken up by notes on foundry practice, tables, rules, etc., of use to foundrymen.

The book is printed on good paper, 7½ by 5 inches, contains 225 pages, and will certainly be found a valuable addition to any foundryman's library. All readers of *The Foundry* are well acquainted with the author from his contributions to its columns.

Lord's Notes on Metallurgical Analysis. In the March *Foundry* we made mention of this book, stating that it was published by Hann & Adair. We should have stated that the publishers were the Midland Publishing Co., of Columbus, O., the former company being simply the printers. The price should have been stated as $2.50.

Trade Publications.

The Laidlaw-Dunn-Gordon Co., of New York City, have issued a new catalogue entitled Bulletin L 508, which describes their improved Cincinnati Air Compressor. The catalogue is very neatly printed on coated paper and contains considerable matter of interest in regard to this new type of compressor.

The Brass Foundry Supply Co., of Newark, N. J., have published a new edition of their catalogue No. 12. It is 6 x 9 inches and contains descriptions of all equipment necessary for a brass foundry. It is well illustrated and printed on good paper.

The National Electric Co., of Milwaukee, Wis., have issued a very neat catalogue describing and illustrating alternators. These machines are especially intended for central power station work and the catalogue will be found of interest to any who are planning to equip new plants with a central electric station and electric motors for power purposes. They also publish catalogues describing their direct current motors.

The Rochester Flask Works, Rochester, N. Y., have issued a catalogue 4½ by 6½ inches, describing the various styles of snap flasks and rammers which they manufacture.

The P. & F. Corbin Co., of New Britain, Conn., are sending out a new advertisement in the form of a picture of the sky line of New York City. It is printed on good paper, 14 by 40 inches, and shows all the principal buildings. Below the picture are printed the names of the various buildings.

The United States Sanitary Engineering Co., of Washington, D. C., have issued a very neat catalogue, 7 by 9 inches, describing the "Winner" screen.

The International Steam Pump Co., of New York, have issued a catalogue of the Worthington Centrifugal Pumps, in which they describe a class of pumps especially designed for pumping against high heads. They have carried on experiments and designed a set of pumps especially to meet these requirements and are now ready to furnish equipment to pump any volume of water against any head up to 2,000 feet.

The Falls Machine Co., Sheboygan Falls, Wis., has issued a neat folder describing its saw table.

The Browne-Sharpe Mfg. Co. has issued a 1904 edition of its catalogue of machinery and tools, which contains, in addition to the old standard line, a number of new tools and devices.

Hammacher, Schlemmer & Co., of New York city, have issued three new catalogues. The first deals with saws, saw sets, etc. The second with tools and supplies for shipping departments and janitors, including devices for lettering and stamping and quite a full line of tools, trucks, handling apparatus, etc. The third is a 42-page catalogue dealing exclusively with wood planes. These catalogues will be found of special interest to those interested in these lines.

B. F. Sturtevant Co., Boston, Mass., have issued a second edition of their catalogue No. 115, which contains matter of interest concerning the blowers, engines, bench legs, pattern storage shelf brackets, electric hoists, cast-iron sinks, trench cover plates, industrial railway equipments, etc., made by them. Also a description of their heating and ventilating systems.

The C. H. Caldwell & Son Co., Chicago, Ill., have issued a very neat book entitled "Gears." All who are familiar with gearing will remember the old Walker gearing books of the Walker Mfg. Co. The Caldwell Company purchased the gearing interests of the old Walker Company and the present book is an outgrowth of the Walker Gear Practice and will certainly be found of interest to all who are interested in the subject of spur gearing. The catalogue also contains descriptive matter concerning hangers, clutches, couplings, band and rope wheels, conveyors, etc.

The C. W. Hunt Co., West New Brighton, Staten Island, N. Y., have issued a catalogue of industrial railways, entitled Catalogue 038. This is a very complete catalogue showing the different styles of industrial railways and many applications of the same, also various accessories for use in connection with industrial railways such as cranes, scales, storage battery locomotives, cars of standard and special types and, in fact, all classes of equipment, for this system of transportation. The book also contains valuable information and memoranda for architects, engineers, etc.

The Mt. Carbon Co., Powellton, W. Va., have issued a neat little booklet describing the Powellton Foundry coke and stating its advantages over other classes of coke. This publication contains much matter which will be found of interest to all foundrymen.

The American Air Compressor Works, 26 Cortlandt St., N. Y., have issued a little booklet 6 by 3½ inches containing valuable information in regard to compressed air installations. This booklet of their complete catalogue will be forwarded to any one upon application and will be found to contain a large amount of valuable matter concerning the use of compressed air.

PERSONALS.

Mr. Geo. S. Ashworth, superintendent of construction of the Tennessee Coal, Iron & Railway Co., at Ensley, Ala., has resigned his position and accepted the position of general sales agent with the Hardie-Tynes Machine & Foundry Co.

Frank P. Johness, who for the past eight years has been superintendent of the Columbus, O., plant of the United States Cast Iron Pipe & Foundry Co., has resigned to accept the position as superintendent of the Racine Steel & Iron Mfg. Co., Racine, Wis. His old associates of Columbus presented him with a gold watch and chain.

Wm. H. Rudge, formerly of the Forsythe Pattern Co., has accepted the position of secretary and treasurer of the American Pattern Co., Cleveland.

George J. Chandler, for the past ten years identified with the Cleveland Steel Casting Co., has recently resigned his position of secretary and assistant treasurer of that company, and hereafter will devote his time to the brokerage business. The new firm will be known as Geo. J. Chandler & Co., and will locate at 452 The Arcade, Cleveland, doing a general brokerage business in iron and steel scrap and foreign alloys.

Mr. H. P. Frohman, manager of the S. Obermayer Co., Cincinnati, has been in St. Louis conferring with the exposition officials with a view to securing a site for the model foundry.

Mr. John Walker, formerly of the Walker Manufacturing Co., of Cleveland, O., later superintendent of the Frazer & Chalmer Co., Chicago, and the M. C. Bullock Manufacturing Co., Chicago, is now located at Magnolia Springs, Baldwin County, Ala. He owns the Hotel Woodbound and has retired from active foundry business and settled at this point in the South. In some way a rumor has become current that Mr. Walker was dead, but his

many friends will be glad to know that he is well and prospering in the above location.

Harry Fisher has resigned his position as general foreman of the Lorain Foundry Co., of Lorain, O., to accept a like position with the Buffalo Foundry Co., of Buffalo, N. Y., the change being made April 1st.

DEATHS.

Lyman Ives Todd died at Chicago on March 12th. He was born in 1828 at Mt. Carmel, Conn., and came to Chicago in 1852, where he was employed by the Illinois Car Co. as a molder of brass trimmings. In the early sixties he went into the brass foundry business for himself. He was very successful in this business and later merged his interests with those of the Adams & Westlake Co. Ten years ago he retired from business.

John S. King, business manager of the *Iron Age* and the *Metal Worker*, of New York, died at his home in Brooklyn, on March 4. He was born at Middletown, N. Y., on Oct. 1, 1841. As a young printer, he answered the first call for volunteers in the Civil War and enlisted as a private in the 18th regiment of New York Infantry. He served until the regiment was disbanded, when he re-enlisted, entering the 12th New York as a first lieutenant. He was wounded by one of the last shots fired in the battles before Richmond before its surrender. His injury confined him to the hospital for many months and frequently incapacitated him in recent years. In 1868, he went to New York and the year following became business manager of the *Iron Age* and allied publications of David Williams. In 1898, when the David Williams Co. was formed, he was made treasurer. He was also treasurer and general manager of the Williams Printing Co.

S. S. Vail, who in 1849 founded the foundry company known as the Vail-Armitage Co., Keokuk, Ia., and conducted the business until 1876, died in Loomis, Cal., March 3.

Geo. F. Cobb, of Carver, Mass., died recently at his home in Carver. He was born in Federal, Mass., in 1835, and was practically brought up in the foundry business, as he was around the old Federal foundry when a boy and later was apprenticed at the Charlotte Furnace. Later he moved to Roxbury, where for a period of nearly thirty years he was employed by the Highland Foundry Co., first as molder and later as superintendent. About five years ago he retired from active business and purchased a house at Rock, where he has since resided.

George Downing, pioneer foundryman of Rock Island, Ill., died Feb. 25 at the home of his son in Talmage, Kan. Mr. Downing was 81 years of age and had lived almost 50 years in Rock Island, where he established the Downing Foundry and was active in its management until seven years ago, when he retired.

FIRES.

The Marshall Car-Wheel Foundry Company's plant at Marshall, Texas, was damaged by fire to the extent of $1,000 on March 3d.

Fire destroyed the foundry of the Williams Foundry Machine Co., Cuyahoga Falls, O., Feb. 19. Loss $2,500.

Fire destroyed the roof of the foundry of the American Bed Co., at St. Louis, Mo., on Feb. 25th. The loss was $4,000, fully covered by insurance.

The Peck-Williamson Furnace Co.'s plant, at Wellston, O., consisting of a machine shop, foundry, boiler shop and engine house was recently destroyed by fire; loss, $100,000.

The Knoxville Wheel & Car Foundry Co., of Knoxville, Tenn., was recently completely destroyed by fire. This is a new concern which was established only about a year ago. W. P. Richards is president and W. D. Williams is secretary and treasurer.

Fire in the pattern shop of the Central Iron Co.'s plant, Newark, N. J., Feb. 20, caused a loss of $1,000

The Clendinneng Foundry, at Ste. Cunegonde, Ont., was recently damaged by fire to the extent of $1,000. The molding department and pattern shop received the most of the damage.

The Sherbrooke Stove Works, of East Sherbrooke, Ont., were visited by fire on March 14th. The office, pattern shop, store room and stock room were destroyed. The loss is $3,000, partly covered by insurance.

NEW CONSTRUCTION.

The Michigan Brass & Iron Works, Detroit, will build a new core shop which will be equipped with the most improved machinery.

The American Radiator Co., of Chicago, Ill., have secured a large tract of land at Litchfield, Ill., where they expect to erect a group of buildings, including two foundries each 90 by 425 feet, core room and core oven building

90 by 125 feet; machine shop 90 by 160 feet: storage and warehouse, 120 by 320 feet, together with offices and the other necessary buildings.

The Link Belt Engineering Co. will erect a one-story brick pattern shop building, 40 x 96 feet, at Hunting Park avenue and Reading Railway, Philadelphia. The cost will be $4,000.

The plant of the Wheland Machine Co., of Chattanooga, Tenn., is to be enlarged this summer. They will construct a new foundry 110 by 200 feet, together with several other new buildings.

The Kimball Foundry Co., Oklahoma City, Okla., is erecting an artificial stone building which will be equipped with modern machinery.

J. J. Hanford, proprietor of the Hanford Iron Works, San Bernardino, Cal., has awarded the contract for a machine shop 40 x 88 ft. The second floor will be used for a pattern room. A number of lathes and other machines will be installed.

A building 50 x 200 ft., two stories, will be erected by the Noble Foundry & Machine Co., Fort Wayne, Ind. The company's business has increased so that this addition, which will double its capacity, has become necessary.

The citizens of New Richmond, O., have raised the money necessary to secure the establishment of the Columbia Foundry Co.'s plant at that place. A foundry 80 x 125 ft. with a boiler room adjoining will be erected.

The Bath Foundry & Machine Co., Bath, Pa., are erecting a new foundry building 40 by 140 feet.

Williamson Bros. & Co. will build a large addition to their foundry at Thirteenth and Hamilton streets, Philadelphia.

The York Foundry & Machine Co., recently organized at York, Pa., will erect a foundry building on its tract of three and a half acres. The building will be 231 by 100 feet, brick with slate roof. This company is closely affiliated with the York Safe & Lock Co. S. Forry Laucks is vice president, treasurer and general manager of both companies.

I. G. W. Davies and Mr. Stengle have formed a partnership and will build a foundry at Wellsburg, O., The building is to be 60 by 168 feet.

GENERAL INDUSTRIAL NOTES.

The Wichita Bridge & Iron Co., of Wichita, Kansas, are improving their plant and adding new machine shops and foundry.

The Locomotive & Machinery Co., Ltd., of Montreal, Canada, has been purchased by the American Locomotive Works.

The commercial club, of Faribault, Minn., has made arrangements with the Winnebago Gas Engine & Foundry Co., of Winnebago City, for the company to move its plant to Faribault.

The Sheffield Stove & Foundry Co., of Sheffield, Ala., have recently received from a large wholesale firm in S. C. the largest order for stoves ever given to an Alabama foundry. The order calls for $25,000 worth of stoves.

The Selma Stove Works, of Selma, Ala., have been organized with a capital of $20,000. The officers are: W. C. Smith, president; Henry Franelich, secretary and treasurer, and W. A. Smith, manager.

The firm of Gage & Rowe, proprietors of the Burford Foundry & Machine Works, Burford, Ga., has been dissolved. The business will be continued by D. H. Gage.

The Vokes Hardware Co., of Toronto, Canada, have purchased the old Rennie Wharf and expect to use it for storage and shipping purposes and also to erect a foundry upon the property.

The Cheraw Foundry & Machine Co., Cheraw, S. C., now has its new foundry in full operation. Considerable new machinery has been installed in the shops.

The National Steel Foundry Co. put its new foundry into operation in its plant at New Haven, Conn., a few days ago. The corporation was organized a year ago and ground was broken for the foundry plant, June 2, 1903. The new foundry building is 408 ft. long, 165 ft. wide and 57 ft. high.

The site on Artizan street, New Haven, Conn., occupied for a number of years by E. Stannard & Son, iron founders and patternmakers, has been sold to the Consolidated railroad. Negotiations are now being conducted for the sale of the Stannard business.

The Gibby Foundry Co., of Boston, Mass., have purchased the Condor Iron Foundry Co.'s plant.

The Wilson Positive Blower Co., New York, has been incorporated with a capital of $50,000, to manufacture blowers.

The Shawmut Railroad Co.'s foundry at Angelica, N. Y., which has been closed down for some time, is again in operation in connection with the machine shops at Angelica.

The Summit Foundry Co., of Geneva, N. Y., has increased its capital from $100,000 to $200,000.

The Brooklyn Foundry Co., of Brooklyn, N. Y., has been incorporated with a capital of $100,000.

The Ridgway Foundry Co., of Ridgway, Pa., has been incorporated with a capital of $10,000. The incorporators are: J. Flinn, Chas. Weschler and Jas. Bush. They have commenced the construction of a foundry building 80 by 150 feet.

The Royersford Foundry & Machine Co., of Royersford, Pa., has been incorporated with a capital of $100,000.

The National Brass & Iron Works, of Reading, Pa., have elected the following directors: John G. Mohn, William H. Mohn, Walter A. Rigg, Luke E. Fichthorn, Arthur V. Arrowsmith, Lambert A. Rehr and W. W. Light. The directors re-elected the following officers: President, John G. Mohn; vice president, Walter A. Rigg; secretary, William H. Mohn, and treasurer, W. W. Light.

The York Foundry & Machine Co., of York, Pa., will build a foundry at some time in the near future. The projectors are: Israel Loucks, S. Forry Loucks and J. A. Dempwolf.

The Marion Mfg. Co., of Marion, O., has been incorporated with a capital of $400,000. They are to manufacture machinery. The incorporators are: Fred Haberman, Charles C. Fisher, Horatio Chisholm, William H. Schaffner, and August C. Edmondson, all of Marion, O.

The Favorite Stove & Range Co., Piqua, O., nas been incorporated with a capital of $300,000. Incorporators are: A. M. Orr, Stanhope and W. K. Boal, C. Windelman and E. W. Lape.

The Berkshire Mfg. Co., of Cleveland, O., has been incorporated to manufacture molders' supplies, capital $100,000. The incorporators are: Norton T. Horr, H. J. Caldwell, C. L. Denton, A. R. Horr and H. H. Allyn.

The stockholders of the West Chicago Foundry Co. have elected the following officers: S. T. Nickelson, president; A. J. McCarthy, vice president and secretary; W. G. Fricke, treasurer.

The United States Cast-Iron Pipe & Foundry Co. was awarded a contract for supplying 800 tons of water pipe, specials and loam castings for the Cincinnati water works, the price being $31,000.

The Aluminum & Bronze Castings Co., of Cleveland, O., formed by R. C. Koblitz and N. T. Henderson, has established a foundry and will furnish aluminum, bronze, copper and brass castings. They also manufacture the Diamond bearing metal.

The C. E. Sutton Co., of Toledo, O., has been incorporated with a capital of $200,000. They are to do a general foundry and manufacturing business. The incorporators are: Charles E. Sutton, Curtis T. Johnson, Ralph S. Holbrook, S. D. Carr and E. F. Rowley. This company succeeds to the business of the old Caldwell Furnace Co.

Eight iron molders' unions of Chicago will submit to the city council a plan for a municipal iron foundry. The molders claim that contractors charge excessively high prices and have work done in other cities, while molders of Chicago are idle.

The American Malleable Iron Co., which was incorporated in 1902, has been declared bankrupt. The company's plant is located at Chicago Highlands, near Barrington, Ill. Ryerson P. Gates and Henry L. Wilson were appointed receivers of the company several weeks ago. It is expected that the plant of the company, whose value is estimated at $150,000 will be sold.

N. P. Anderson has become sole proprietor of the plant and business of the Edgerton foundry, Edgerton, Minn. His former partner, Carl Collins, having sold out his interest to Mr. Anderson.

The August Schwab Iron Works, Two Rivers, Wis., which succeeded the Two Rivers Iron Works, have again changed hands. Frank Becker, formerly of Two Rivers, now of Milwaukee, has bought the equipment and secured a lease of the plant and will soon take charge.

The Prince Foundry Co., of Muskegon Heights, Mich., has been sold to the E. H. Stafford Co., of Ionia, Mich., and will be moved to the latter city. Mr. Prince, who was proprietor of the company bearing his name, will be superintendent of the foundry in Ionia.

George Edward Adams, James Francis Howe, and Charles Burnett Jr., have purchased the plant of the Bay City Iron Works, Bellingham, Wash., and have formed a corporation known as the Industrial Iron Works. The capitalization of the new concern is $25,000. The plant will be enlarged and the company will manufacture and repair locomotives, general machinery, boilers and electrical machinery.

The California Mfg. Co., of San Francisco, Cal., have recently moved their plant into their new building, which places them in a much better position to fill all orders for castings.

Application has been made for the incorporation of the Stanton Foundry & Machinery Co., Palatka, Fla. The company will manufacture and repair machinery, boilers, gas and gasoline engines, etc. The capital stock will be $15,000. The temporary officers are Christopher Stanton, president: E. N. McNabb, vice president; H. M. DeMontmollin, secretary and treasurer.

The Rockmart Stove & Foundry Co., Rockmart, Ga., has been incorporated with a capital of $12,000, to manufacture stoves and castings. They have built a foundry 80 by 120 feet and have started on a co-operative plan, commencing with 10 or 12 molders. Jas. Long is president, L. Kimball, vice president, and H. A. Powers secretary and treasurer.

The Commercial Club, of Hastings, Neb., has made arrangements with Emerick Bros., of Blue Hill, whereby they will remove their foundry to Hastings.

The L. C. Tarras Works, formerly ot the Gate City Foundry, are now located at Winona, Minn. They have added to their foundry a first-class machine shop. They have a good pattern shop and are now fitted up to do all classes of gray iron or brass casting.

The Concord Foundry Co. and the Concord Machine Co. have been merged into one concern and will be known in the future as the Concord Foundry & Machine Co.

The Hartford Pattern & Model Co., of Hartford, Conn., who make a specialty of gas engine patterns for vehicles and automobile work, are contemplating enlarging their plant so as to about double its capacity.

The Davis foundry, Hornellsville, N. Y., has been incorporated with a capital of $20,000.

The National Electric Co., successors to the Christensen Engineering Co., manufacturers of air brakes and electrical machinery, Milwaukee, Wis., have just moved their offices and engineering department to their new building located at the works. The new building is an example of cement block construction and is 200 feet long by 66½ feet wide.

The Cedar Point Foundry, of Port Henry, N. Y., whose foundry was recently destroyed by fire, has taken over the Hartwell Foundry and Machine Shop, of Plattsburg, N. Y., and will move its business there. The machine shop at Port Henry was not damaged and for the present will be operated in connection with their recently acquired plant.

The Allis-Chalmers Company have recently greatly increased the line which they manufacture. They have secured rights for the United States for manufacturing certain lines of steam turbines, hydraulic machinery and gas engines. They have also made arrangements for the construction of electrical equipment. The latter arrangements have been made practical by a union with the Bullock Electric Co., of Cincinnati., O. This places the Allis-Chalmers Company in a position to furnish complete equipment for almost any kind of plant.

The Fostoria Foundry & Machine Works Co., Fostoria, O., has elected the following directors: O. C. Ringle, of Cleveland, N. Portz, J. D. McDonel, W. A. Jones, J. A. Allison and M. M. Carr. The directors met and elected the following officers: President, W. A. Jones; vice president, M. M. Carr; general manager, J. L. Faulhaber; secretary and treasurer, N. Portz. Some needed improvements, including a new roof for a part of the building, will be made at once and the new company will begin operations early in March.

The Rock River Manufacturing Co., of Dixon, Ill., has been incorporated with a capital of $40,000. The incorporators are: John B. Lott, Fred N. Fargo, Zachariah W. Moss. They have taken over the property and buildings of the Sterling Wrench & Tool Co.

The Economical Stove Foundry, of Jacksonville, Ill., has been incorporated to manufacture cooking and heating stoves.

The Gustafson Mfg. Co., Chattanooga, Tenn., has just installed a complete line of patternmaking machinery especially constructed for getting out patterns for self-oiling car wheels.

The National Electric Co., of Milwaukee, is sending out a very neat calendar made up of a dark card to which the calendar pad is attached. The upper part of the card is cut out and a picture of a girl's head set on the back. This gives a mat effect.

The Hornellsville Foundry Co., of Hornellsville, N. Y., has been reorganized and will hereafter be known as the Davis Foundry Co., Ltd. E. J. Davis is president and general manager. J. O. Adsit will be retained as sales manager. Capital $20,000.

The firm of Gage & Rowe, proprietors of the Burford Foundry & Machine Works, of Burford, Ga., has dissolved, Mr. J. T. Rowe retiring. The business will be conducted by Mr. D. H. Gage.

The Damascus Bronze Co. has purchased the property adjoining their plant at Allegheny, Pa., and will enlarge the foundry.

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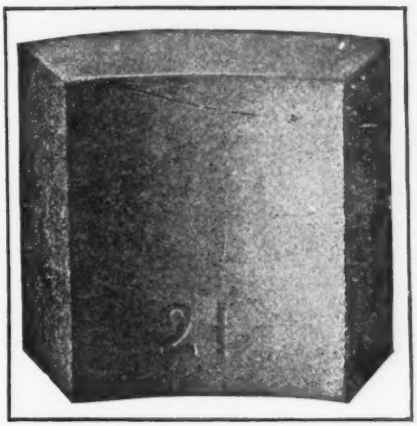

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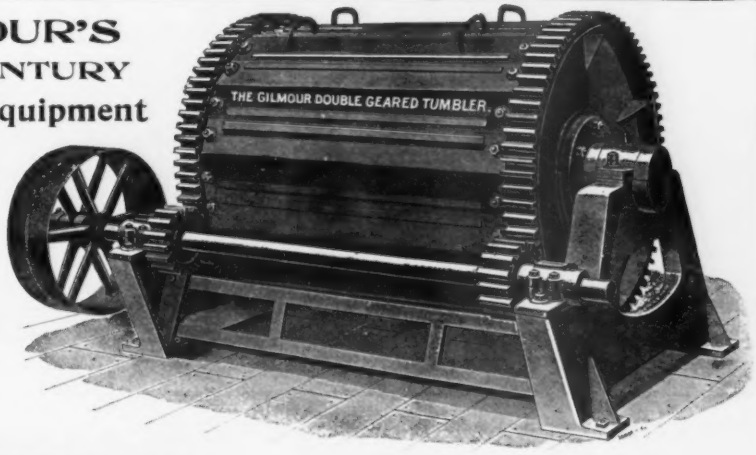

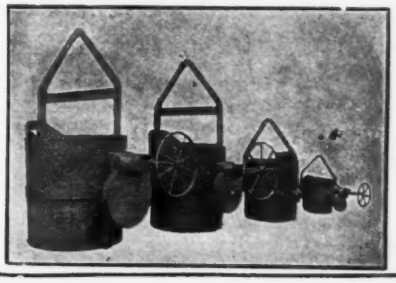

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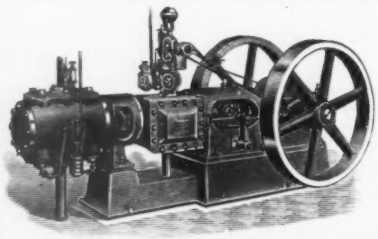

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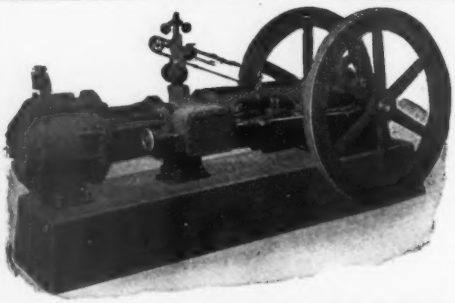

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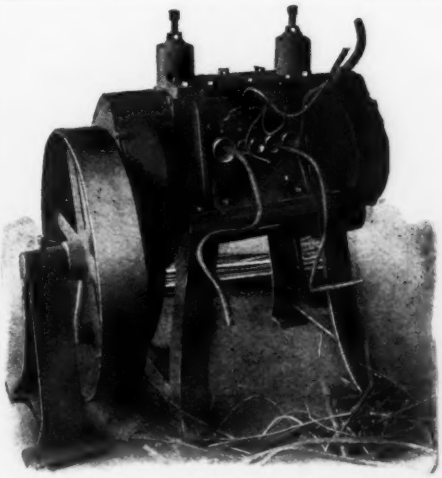

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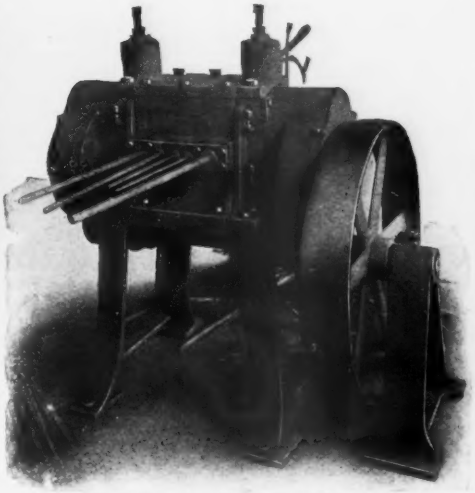

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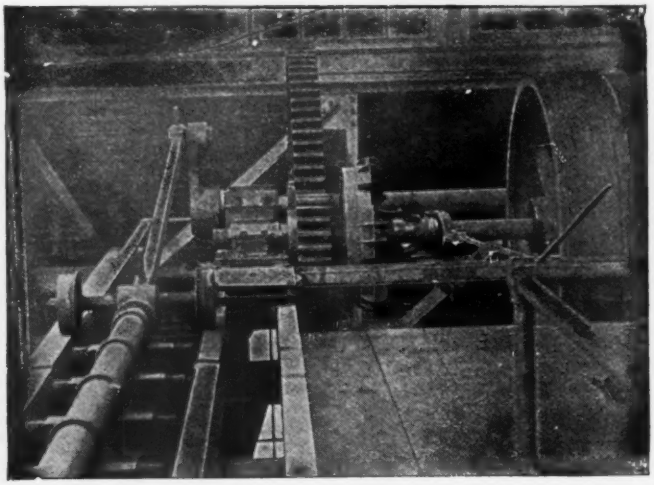

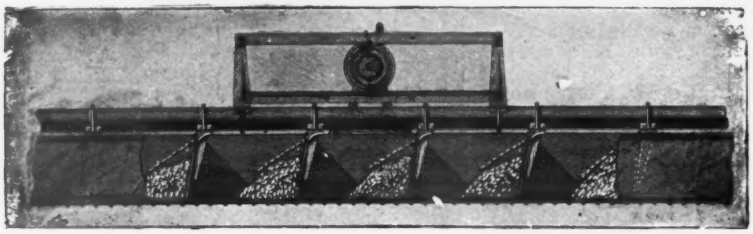

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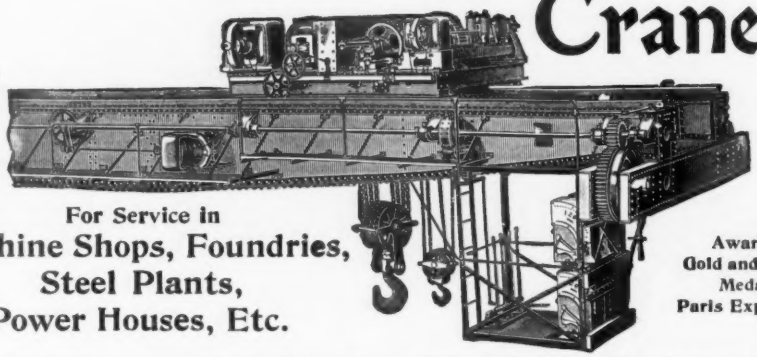

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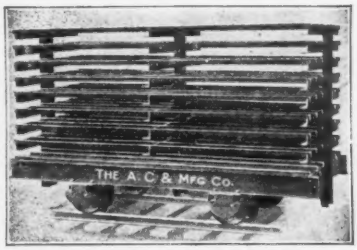

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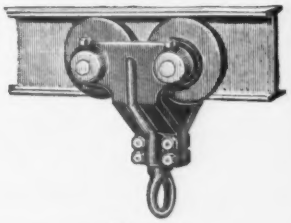

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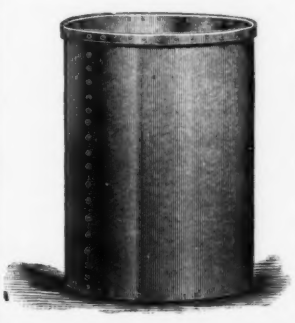

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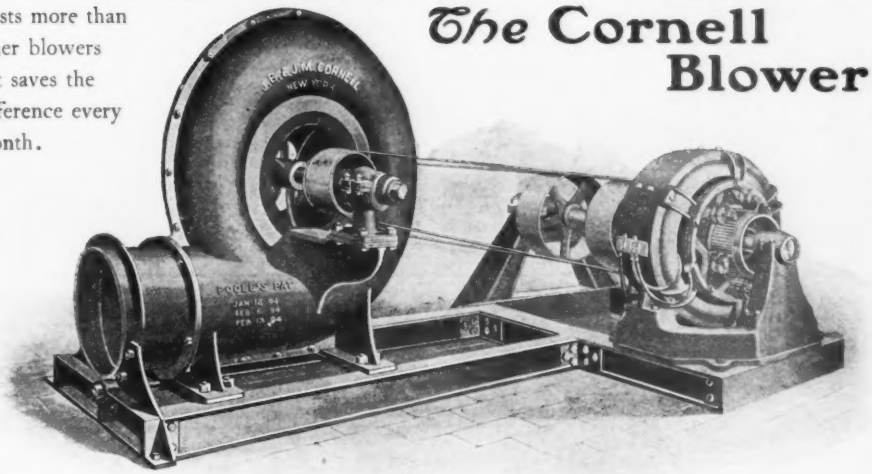

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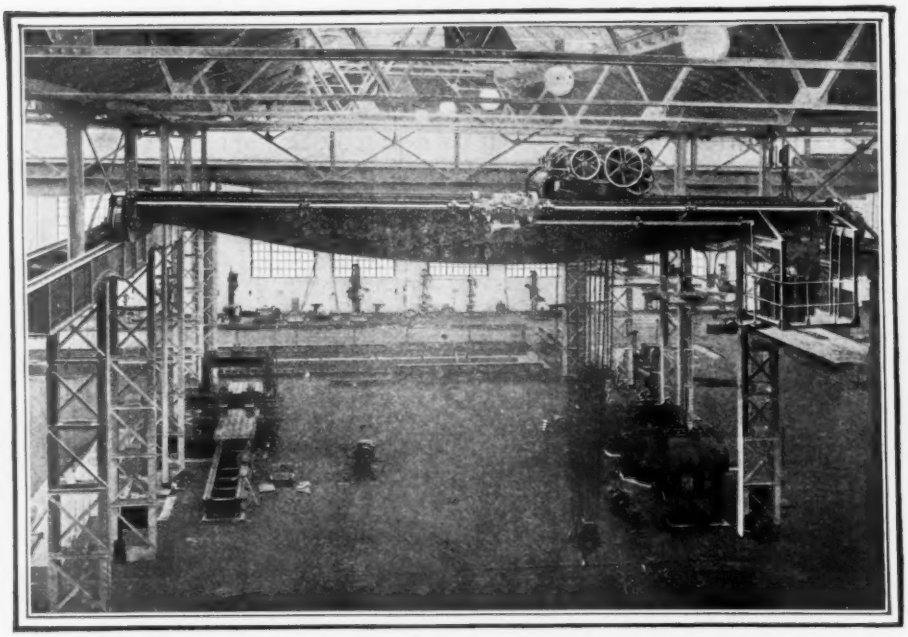

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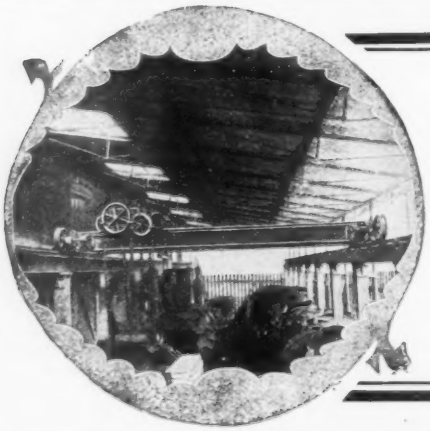

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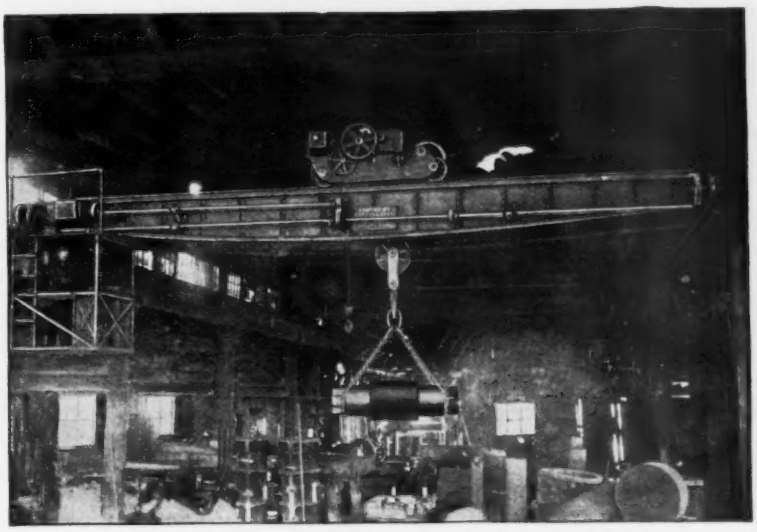

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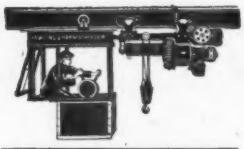

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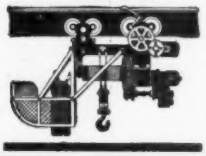

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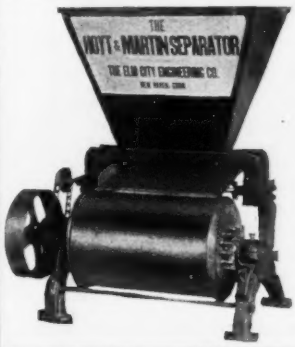

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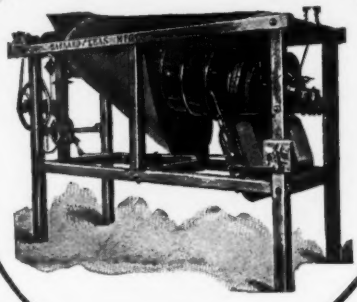

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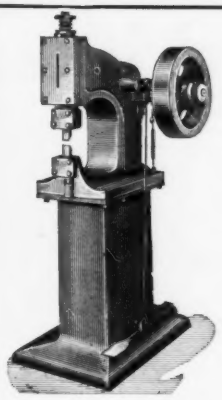

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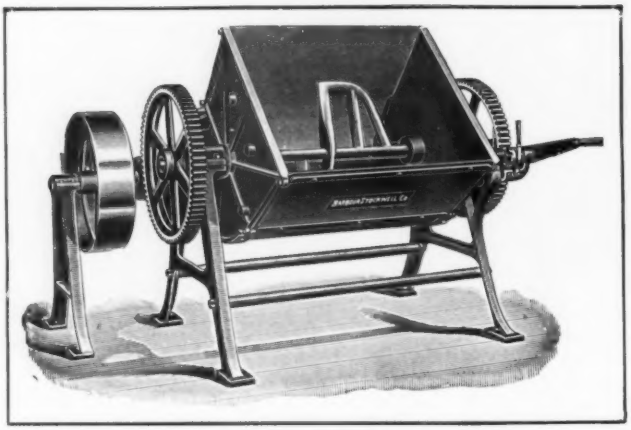

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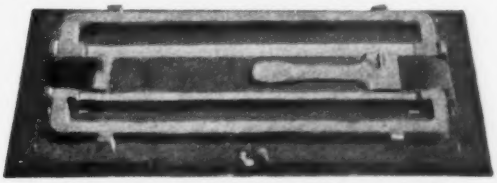

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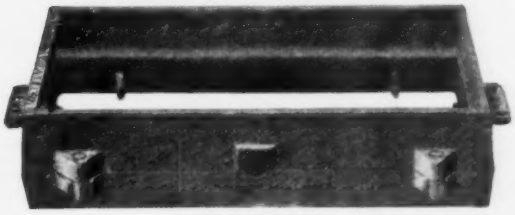

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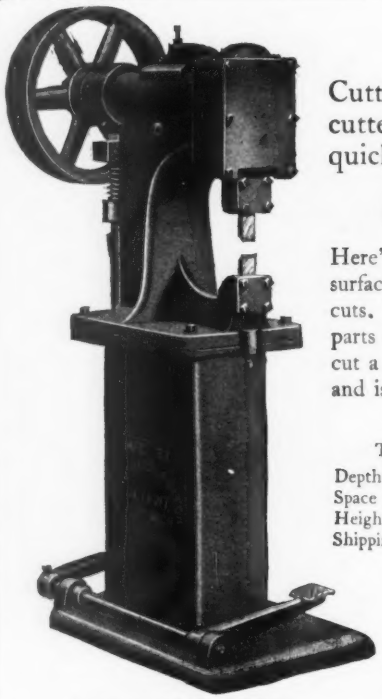

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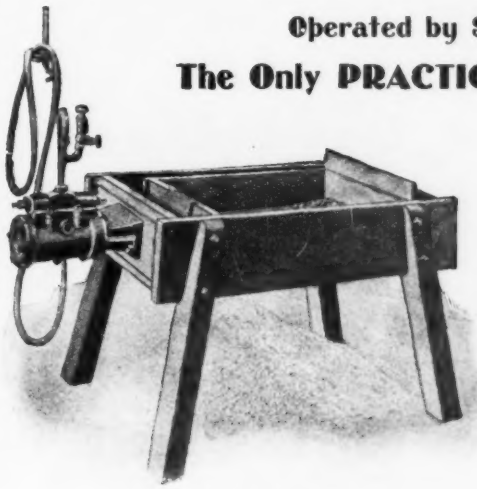

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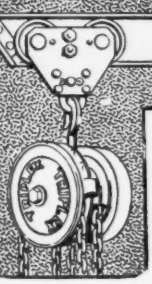
231 North American Bldg., PHILADELPHIA

TRIPLEX BLOCKS



For hoisting safely, easily and quickly. On jibs, travelers and overhead trolleys "Triplex" Chain Blocks will repay their cost several times each year by their time savings, to say nothing of increased ease and safety. We'll prove this by sending you one to try, if you wish.

Write for our Catalog and hoisting hints, mentioning your dealer's name

YALE & TOWNE MFG. Co
9-11-13 Murray St. New York

Established 1856.
HENRY MAURER & SON,
Manufacturers of
HIGH GRADE FIRE BRICK,
420 East 23rd St., New York City, N.Y.

The labor setting 1000 fire brick is fully 70% of the cost of material, irrespective of quality; economy in the price of material is like "SAVING at the BUNG, to waste at the SPIGOT!"

Can you figure

up a mixture to meet your requirements from the analysis furnished you by the furnaces? Others say that Wangelin's "Methods of Calculating Mixtures" is a wonderful help to them. Price, with chart, $1.00.

THE FOUNDRY, Cleveland, O.

PIG IRON

If you are not buying from us, please send in an order and notice the advantages obtainable from doing business with the leading Pig Iron house in the world. We can supply promptly brands containing

Silicon from .50 to 50.00%

Phosphorus from .09 to 10.00%

Manganese from .10 to 80.00%

Specify what you want in quality, grade, analysis and fracture.

We can select for you from fifty different brands handled by us.

FOUNDRY AND FURNACE COKE

Our Coke trade has increased enormously, and is still growing.

We represent the best products of the following districts and are prepared for orders from a single carload up to the requirements of blast furnaces.

Connellsville
Pocahontas
Virginia
Kanawha
New River
Alabama
Tennessee

PLEASE WRITE FOR PRICES

Rogers, Brown & Co.

NEW YORK BOSTON CHICAGO
CLEVELAND PITTSBURG ST. LOUIS
CINCINNATI BUFFALO BIRMINGHAM
PHILADELPHIA